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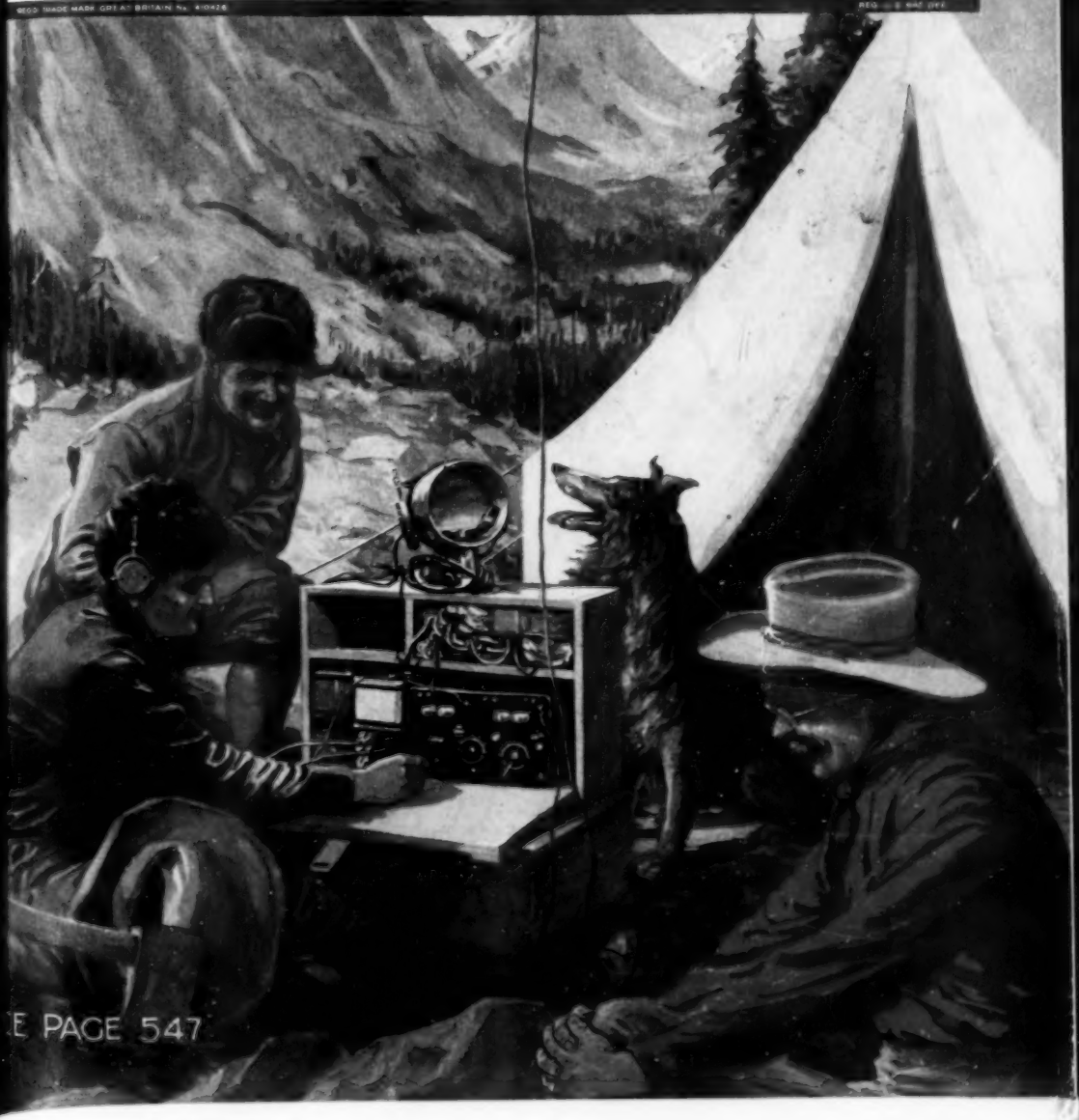

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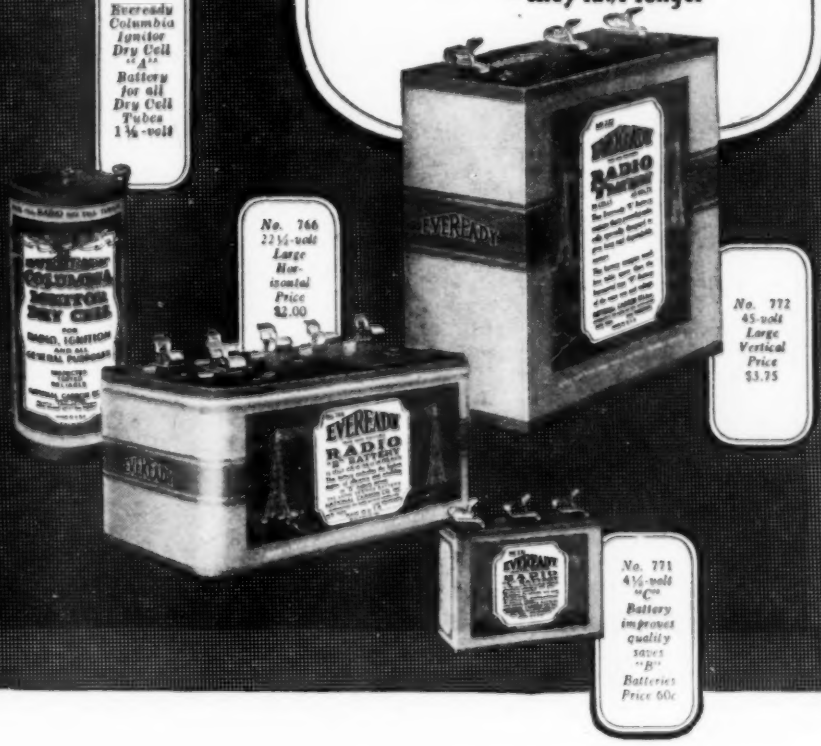
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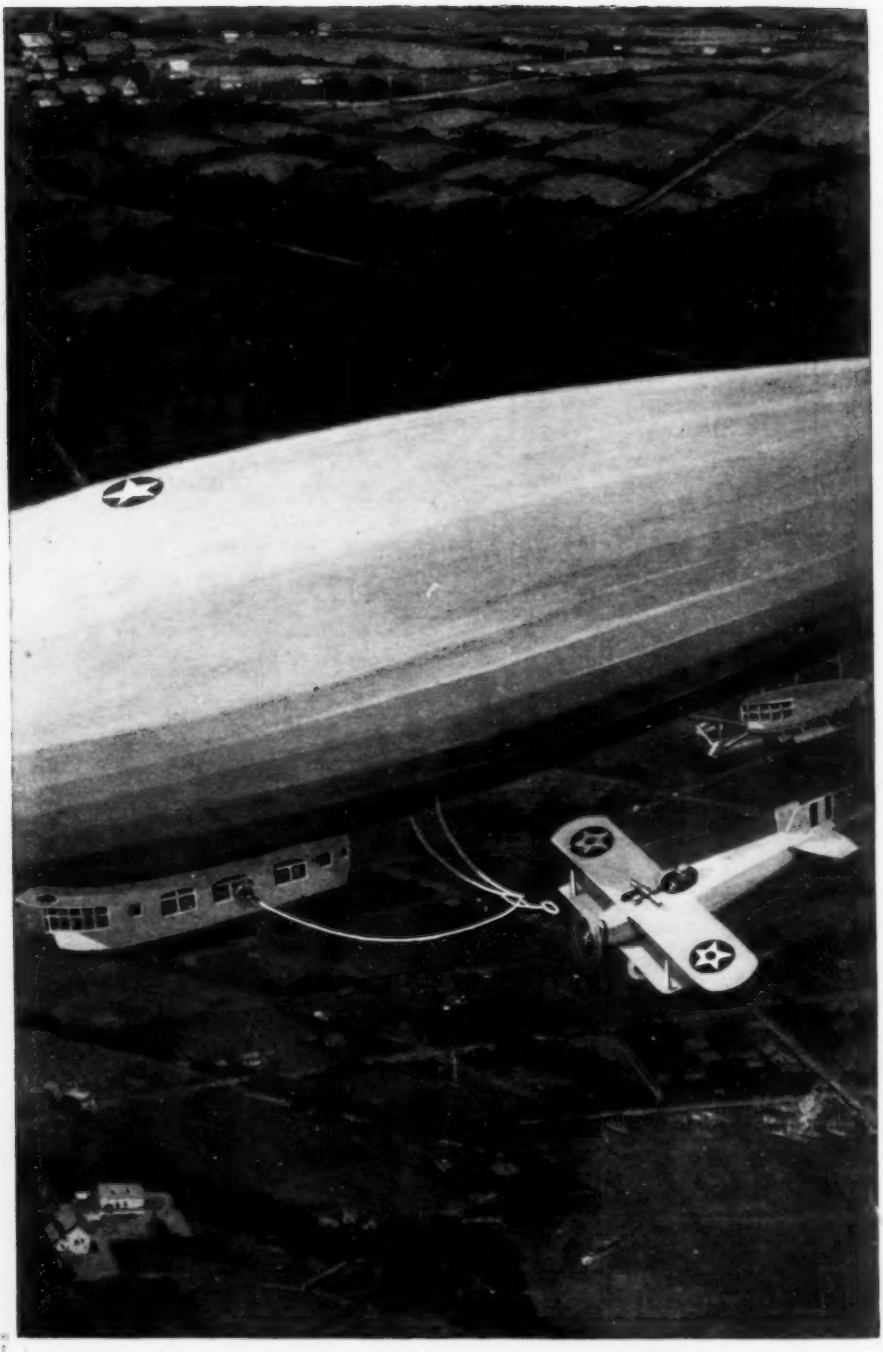

Artist's Conception of Airplane "Hooking On" to Airship, as Successfully Demonstrated by American Army Pilots in Tests at Scott Field—See Page 570

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ARTIFICIAL SNOWSTORMS TO FREEZE FIRES

FIRE extinguishers which will literally freeze a fire to death, while covering the burning area with a dense gas, which bars all air and oxygen on which the flames might feed, have been devised for fighting switchboard fires, and also for oil tankers and other ships where fires in the cargo hold present a serious problem.

The extinguishers, which are merely tanks loaded with the carbon-dioxide gas used at every soda fountain to carbonate the soda water, eliminate the water damage which forms one of the greatest losses in ordinary fire fighting.

In the tank in which the soda fountain proprietor buys the gas it is compressed to liquid form, under a pressure of about 900 pounds to the square inch. In that form the contents of the tank retain the temperature of whatever room it may be placed in. But as soon as the valve is opened and the liquid gas is sprayed into the air, it instantaneously drops to a temperature of 110 degrees below zero, and falls as a fine powdery snow. The falling snow is accompanied by clouds of the expanding gas, looking like steam. The gas is so heavy that it falls over the fire surface, displacing all air, and cutting off the supply of oxygen, without which fire cannot exist.

The ability of the gas to put out fire has been known for many years, but the problem has been to design a nozzle which will

The Gas That Carbonates the Soda Water Is the Same Material Used Now to Extinguish Fires

not freeze up from the intense cold caused by the expansion of the gas. It finally has been solved by making the outlet hole very small, so that contraction of the gas rushing through it offsets the cold, producing expansion outside. The nozzle is supplemented with a megaphonelike horn. The research work was done by Dr. Charles L. Jones, of the Mellon Institute, Pittsburgh, Pa.

Commercial carbon dioxide is made by burning coke. The flue gases contain 18 per cent of carbon dioxide. They are drawn off through superheaters, scrubbing and washing towers, which remove soot and other gases, then through a lye boiler and into an atmospheric cooler, which separates the remaining water vapor from the pure carbon-dioxide gas. It then passes through three compressor stages, with alternating coolers, until it finally passes out as a hot gas at a pressure of 1,200 pounds to the square inch. A final cooler reduces the gas to a liquid, and brings the pressure down to 900 pounds. From the outlet pipes by which the liquid is passed into the soda water fountain tanks and fire extinguishers, the gas can be released into a bucket in the form of snow, with its temperature of 110 below zero, or 142 degrees below the freezing point of water. A bucketful of the snow dumped out on a table in the sun will last for more than an hour, and when the last bit finally disappears, nothing is left behind, not even water, since it contains no water, and disappears in the form of a gas.

The snow is so cold that a piece held in the hand for more than a second or two will cause a burn, just like a lighted match. Burns are the reaction on the skin of the rush of heat through it, and it makes no difference which way the heat rushes, into or out of the hand, the resulting effect on the skin is the same.

The carbon-dioxide snow is so cold that its temperature cannot be measured with an ordinary mercury thermometer, since mercury solidifies at fifty degrees below zero. This is demonstrated by hollowing out a cup in the top of a pile of the snow and filling it with mercury. In two or three minutes the mercury is a solid lump of metal, firm enough to drive a big spike through a heavy board. A steak placed on the snow will freeze so hard that when dropped on the floor it will break into a multitude of pieces. One way of testing rubber tubing in the laboratory is to cover it with carbon-dioxide snow, then take it out and break it in pieces in the hands. The frozen tubing snaps like a match stem.

Besides its use in carbonated beverages and for putting out fires, carbon dioxide can be used as a leavening agent in baking bread, for ripening citrus fruits, storing apples, grapes, grain and other crops, for spray painting, operating railway signals, cleaning plumbing, motive power for torpedoes, testing pipes for leakage and inflating automobile tires.

As a low temperature agent it is used in mechanical refrigerators instead of ammonia or other dangerous gases, as a starter for liquid air machines, as a refrigerant and local anesthetic in medicine, for freezing mixtures and testing samples in the laboratory, for humane killing of animals and for invigorating carbonated baths. In chemical industries it plays a part in the manufacture of salicylic acid and aspirin, in boiling out cotton and wool, in the making of white lead, in distilling various products, and the manufacture of pure carbonates. The rubber factories use it in inflating air bags, making cellular products and for atmosphere in dry-cur-

ing rubber. It will loosen some types of boiler scale and treat water.

Its most spectacular use, however, remains as a fire extinguisher. In a test recently a forty-five-second capacity cylinder was turned on a bonfire built up of wood, old boxes, papers and excelsior, on which had been poured a gallon of fuel oil and a gallon of kerosene. The flames were leaping eight feet in the air, but in three-quarters of a second the fire was out, leaving behind quantities of snow. The snow was so cold it did not melt in the very heart of the fire.

Seaplane with Hull Like a Boat Has Wheels for Land Use

An airplane of metal, designed for operation over both land and sea, has a boat-like hull instead of pontoons to keep it afloat in the water. The craft carries a crew of three and sufficient fuel for a non-stop flight of 700 miles. In emergencies the gasoline storage can be greatly increased to permit extended cruises. The ship, which is constructed for coastwise or inland service, has been put under tests by the army aviation division. It is also expected this type of flyer might be used for commercial transportation where flights are to be made between seaports or along inland waterways. The motor of the machine is of the inverted model which places most of its bulk below the thrust line of the propeller, materially aiding the progress of the plane.

Getting News of Next Week's Show from Illuminated Sign Carried on Usher's Back

Theater Ushers with Signs on Backs Announce Coming Attractions

Illuminated signs carried on the backs of ushers are being used in a California motion-picture theater to announce approaching attractions. As the attendants reach the darkened aisles, they press an electric switch carried in the hand. A tiny bulb over the sign flashes and persons following have a chance to read the legend on the card before reaching their seats.

Metal Seaplane with Wheels Attached to Boatlike Hull, for Use in Ground Landings, Which Carries a Crew of Three and Fuel for a 700-Mile Non-Stop Flight

Dead Animals Made to Look Alive by Sculptor's Skill

In the heart of New York city is a sort of jungle where wild animals are grouped about in lifelike postures, and rare species of birds are poised on the wing as though pausing in actual flight. It is a taxidermist's studio where an expert in the art of stuffing animals has co-operated with a well-known sculptor in achieving realistic poses of specimens killed by big-game hunters for private and public collections. Details, such as the position of the claws and facial expressions of the beasts when fighting, are developed with the same fidelity to nature that the sculptor endeavors to give to his clay when modeling.

Putting "Life" into Stuffed Specimens; Artist with a Bear Mounted in Fighting Pose Advancing to Attack

Autos Are Shipped in Paper Sacks to Keep Out Cinders and Dust

Big paper bags, tightly sealed and fitted, are being used by automobile manufacturers to shield their product from dust and cinders on railroad journeys. They are said to have given better results than cloth containers, are less expensive and keep the autos almost as bright and shiny as they are when they leave the factory. Great care is taken to see that the freight cars are thoroughly cleaned before loading. Water is applied to the roofs to test them for leaks, and the floors are usually covered with dust-proof paper before the automobiles are blocked into place.

Airman Knocked Out in Rapid Flight by Pressure of Wind Past Plane

Absent-mindedly sticking his head out from behind the windshield while making a record flight at the rate of more than 280 miles an hour, Florentin Bonnet, noted French aviator, was knocked unconscious, he told friends after the accident. The force of the wind, he said, struck him on the side of the jaw with the strength of a boxer's blow and he estimated that he was "out" for twenty seconds. He attempted to lean over the side of the cockpit as he was preparing to bank his plane on a turn.

Banks for Sale in Vending Machines Encourage Savings Deposits

Conveniently placed on a window ledge in a Chicago bank, is a vending machine that distributes small pocket savings boxes when a dime is dropped in the slot. This is credited to the depositor when he opens his account. The plan is said to have simplified the task of getting new customers, and serves as a reminder to those who see the machine to save their money.

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Using Savings Box Vending Machine Bank Has Installed on Window Ledge to Attract Customers

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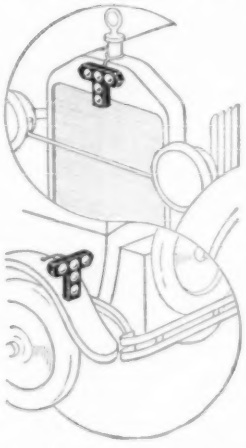
Two Leading Varsity Crews of Great Britain with Every Muscle Stressed for a Final Swift Spurt as Their Crafts Approach the Finish Line of a Hard Contest

Oarsmen Are Found More Efficient Than Steam or Electric Motors

In tests to measure the energy used by trained racing oarsmen, at Yale university, it is said by the experimenters that the rowers showed more efficiency than most gasoline and steam engines, since approximately one quarter of the boatman's power goes directly toward propelling his craft. The driving power of the motors generally registers amounts much below this figure. Special apparatus demonstrated that an oarsman will breathe on an average 3,696 cubic inches of air a minute during a contest. One man will produce almost four horsepower in the early part of a race and will consume body fuel equivalent to about half a pound of sugar.

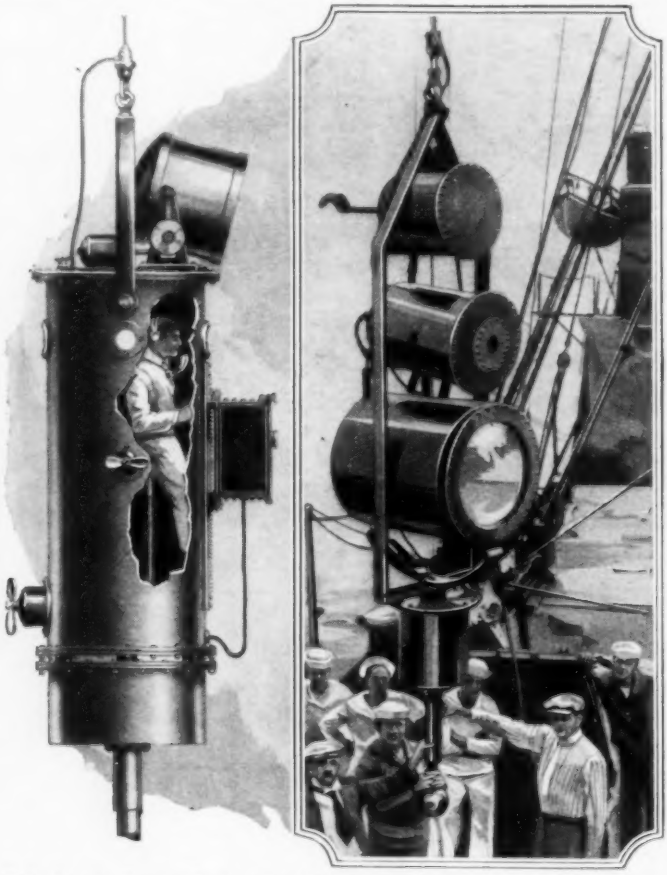
Signals for Both Ends of Auto Show Stop, Go and Turns

A set of colored lights that may be placed both on the front and rear of the car has been devised for greater safety in driving. Red, yellow and green have been chosen to indicate stops, change and safety or "go" signs. In addition to these, there is an orange light signifying that the driver intends to turn to the left and a violet one for a right turn. The latter two are controlled by hand switches and the others work automatically. Placed in front of the radiator in a conspicuous position, the battery of lamps is said to be of special value when the driver contemplates a turn. They give approaching autoists a positive signal of the car's intended course in addition to the usual arm signal, and this is an extra safety measure especially for oncoming cars. The lights consume but little current, are easily installed and the color of the lenses may be changed to conform with the traffic system of any locality.



Deep-Sea Camera to Reveal Wonders of Sunken Fleets and Cities

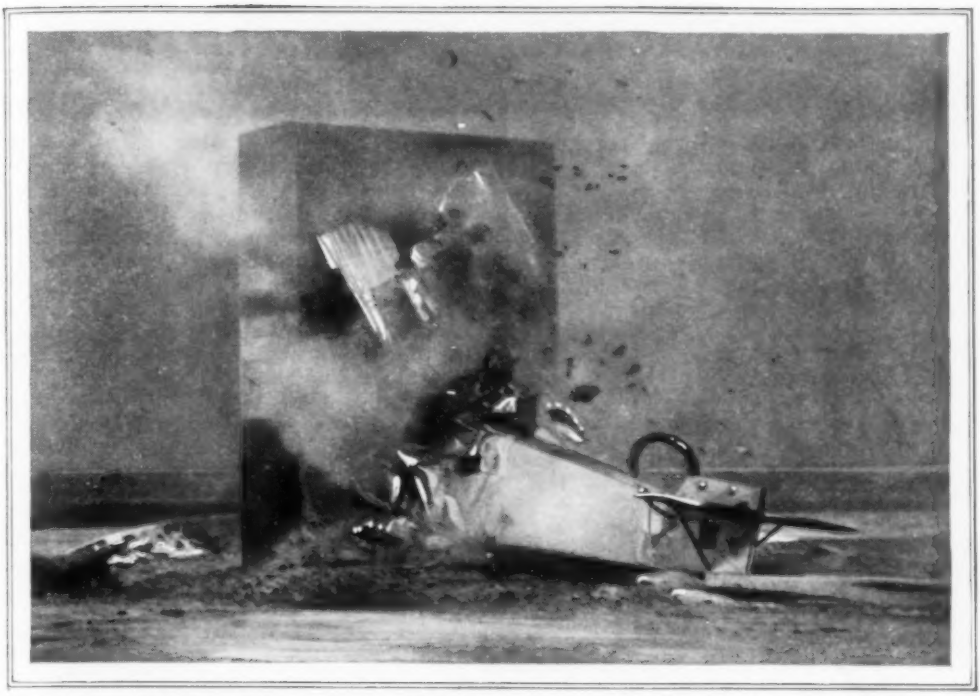
Some of Jules Verne's fantastic inspirations of a half century ago may become a reality through the efforts of a scientific expedition organized to photograph a sunken Roman city discovered at the bottom of the Mediterranean sea and to seek treasures among submerged ruins of vessels wrecked many centuries ago. The submarine camera consists mainly of a steel cylinder, thirty-two inches in diameter, which provides ample space for the operator who occupies a seat in the tube similar to a bicycle saddle. Observations are made through small portholes closed with heavy lenses, and constant telephone communication is maintained with assistants above water for the direction of salvage operations that are carried out with other apparatus. Above the steel cylinder a specially constructed projector will reflect a flood of powerful light on the objects to be studied and photographed, while an artificial screen will be created by filtering a chemical down through the water. This background will also serve to reflect the rays of the light which might otherwise be lost in the dark depths of the sea. Below the main cylinder is suspended a shorter magnetically locked tube containing storage batteries and which is weighted to overcome the buoyancy of the entire structure, causing it to sink. In case of emergency the operator can release and drop this tank, allowing the rest of the apparatus to rise to the surface and safety. The camera, which can take either still or motion pictures, is inclosed in a small water tight covering and may be moved up and down by means of an electric motor and gear connected to a toothed rail. The occupant of the diving device can turn with the camera in any direction or angle desired. There is practically no pressure on the operator who controls all parts of the machine with electric switches and push buttons. Air is constantly renewed while impurities are absorbed by a special device, and the interior of the chamber is warmed by an electric heater. All films will be developed on board the tender ship and examined in a trial projection room before the expedition leaves a particular locality.



Swinging the Battery Tanks and Lights of the Deep-Sea Camera into Position for an Under-Water Descent; Left, Operator in Projector Chamber

Carrier Pigeons and Radio

Observations of carrier pigeons flying over a radio aerial, seem to indicate that the birds' sense of direction is affected by wireless. A Spanish experimenter noticed that as they flew over the antenna, on their way to the pigeon house, they seemed to falter and more or less "staggered" through this part of the area until clear of the wire and then resumed flight. Variations in the wave length did not alter results.



Wrecking an Old Plane against a Concrete Wall at the Army Testing Field to Study Its Weak Points and Determine Dangers of Gasoline Explosion

How Safe Is an Airplane?

Figures Show Air Travel Risk Is Not Much Greater Than That of a Passenger Train, and Less Than Automobile Racing

By MAJOR R. W. SCHROEDER

(Former World's Altitude Record Holder and Ex-Chief Test Pilot, U. S. Army)

MAJOR-General Mason M. Patrick, chief of the army air service, recently told a convention of life insurance presidents that commercial aviation was as safe as railroad travel, and entitled to recognition in the form of more liberal life insurance rates for pilots and passengers. He cited the fact that in three years there was but one passenger fatality on the British and Dutch commercial airways for every 2,663,000 passenger miles flown. This he compared to the record of the American railroads over a number of years up to 1913 of killing one passenger for approximately every two million passenger miles.

Major R. W. Schroeder

Civilian aviation is even safer in many instances than life on the ground. I have figures showing eight people lost their lives in the entire United States in civilian aviation in 1921, and during the same year, in the state of Missouri alone, eighty people—just ten times as many—were kicked to death by mules!

The general public is waiting for air travel to be made safe before taking to it as a regular means of getting from one place to another. But the public has quite overlooked the fact that safety has already arrived—sufficient to warrant the general use of commercial aircraft on a large scale. The post office department for months has been maintaining day and night service from New York to San Francisco

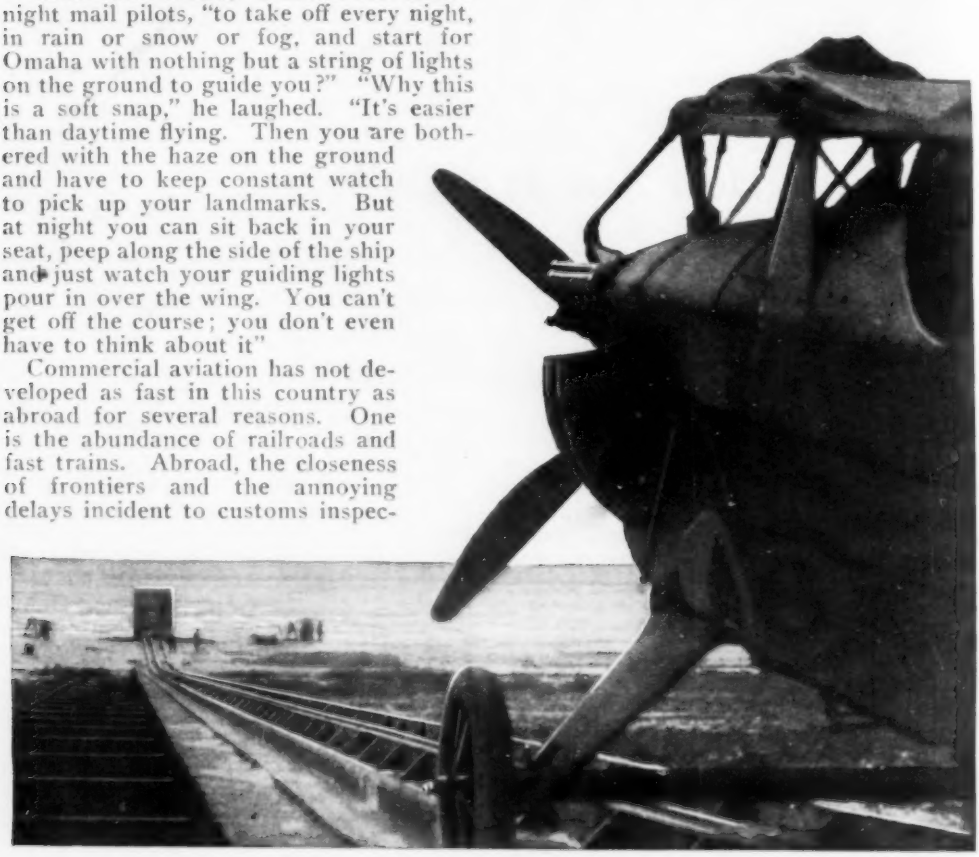
and is now extending the night mail service east from Chicago. In 1922, the banner year of the airplane mail service, post office pilots flew 1,756,803 miles with one fatality, a record that compares favorably with the best showing of the railroads and is far better, undoubtedly, than the automobile death toll. In 1923, when the service was being overhauled and expanded, the death toll was six pilots for 1,870,422 miles, or an average of one death for each 311,737 miles. With night flying under way along a well-charted course, and adequate inspection of equipment, the showing was much better in 1924. The figures for the year were three deaths in 2,151,061 miles of flying, or one life lost for each 717,020 miles.

The perfection of the airplane has reached the point that there are pilots in the mail service who haven't had a forced landing in five years. Their planes and motors function perfectly, thanks to systematic and regular care after each trip.

"How does it feel," I asked one of the night mail pilots, "to take off every night, in rain or snow or fog, and start for Omaha with nothing but a string of lights on the ground to guide you?" "Why this is a soft snap," he laughed. "It's easier than daytime flying. Then you are bothered with the haze on the ground and have to keep constant watch to pick up your landmarks. But at night you can sit back in your seat, peep along the side of the ship and just watch your guiding lights pour in over the wing. You can't get off the course; you don't even have to think about it"

Commercial aviation has not developed as fast in this country as abroad for several reasons. One is the abundance of railroads and fast trains. Abroad, the closeness of frontiers and the annoying delays incident to customs inspections, have helped to make flying popular. The stormy English channel has likewise played a part. Many of the passengers who regularly fly from London to Paris take to the air to avoid seasickness on the channel crossing, as well as to avoid the change from train to boat and from boat to train, with the incidental delays at the customs.

The attitude of the insurance companies, brought out in General Patrick's appeal to their presidents, has also played a part in holding back flying in the United States. Aviation insurance is much farther advanced abroad, though the rates there are still high enough to bring protests from flying men. Lieut.-Col. H. T. Tizard, chairman of the Royal Aeronautical society, in a recent address said: "Flying is unsafe? Here the common-sense view is undoubtedly right. It is unsafe. Not dangerous but unsafe. About as unsafe, let us say, as mountaineering, but hardly as unsafe as motor-car racing."



The Airplane, Held to the Monorail Track, Ready to Start Down the Incline under Its Own Power to Be Dashed to Pieces against Wall in Safety Test

Stored Energy in Flywheel Is Used to Crank Airplane Engines

An airplane engine starter, in which energy stored up in a flywheel by revolving it with a hand crank is used to turn over the motor, has been placed on the market. It is claimed to crank an engine of 600 horsepower or less at three or four times the speed of electric starters and from twelve to fifteen times the speed of hand starters. The device gives the engine from three to eight quick revolutions. The principle employed is the same as utilized in toy automobiles and engines, where a heavy flywheel is stored with energy by giving the toy several quick pushes, and then turned loose, the accumulated energy being returned to the wheels to propel the machine. In the airplane starter, a gear train giving a total reduction of 133 to one connects the flywheel with the crank. A few easy turns of the crank will, in from twenty to thirty seconds, set the flywheel revolving at a speed of several thousand revolutions a minute. A clutch is then engaged and the stored energy spins the engine. Ball bearings support all the gears, which are inclosed in an oil-tight casing, while the cranking handle is equipped with a ratchet release to protect the operator.

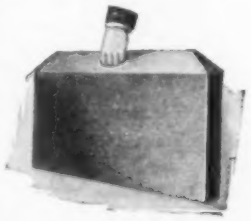
Springs on Sandals Worn as Skates Add to Children's Sport

Spring sandals strapped on like skates and with two stout steel coils fastened between the bottom and a lower leather-padded sole, are now on the market for boys' and girls' amusement. They are made in five different sizes and stiffness of springs for small and larger children, and the springs are so flexible that there is practically no danger of turning the ankle. Walking or jumping with them is said to strengthen the muscles of the feet and legs, and besides providing healthful sport, the sandals lead to the development of new games for the playground.

Sandal Springs with Wide Padded Bottom and Support Straps Are Light and Lengthen the Running Stride

Pasteboard Suit Box with Handle Eliminates Need of String

Fashioned from a single piece of stout pasteboard, a box for carrying suits and similar articles has a handle at the upper edge. It is part of the container itself, being an extension of the sides of the box with a hole for inserting the fingers. The grip will support from thirty to fifty pounds, it is said, saves the bother and uncertainty of string, and as the box is flat and easy to carry, it is suitable for travelers and may be used as ordinary leather luggage. Metal eyelets inserted when the paper is flat, keep the edges together.



Coconut Pulp as Milk Substitute to Be Tried in the Tropics

With the discovery that the pulp of young coconuts contains practically all the nourishing qualities to be found in milk, scientists are experimenting to find out if the substance can be used as a practical substitute for the liquid in the tropics. They plan to extract the moisture from the coconut and mix the dry remainder with milk from the water buffalo, which is said to be more nutritious than cow's milk.

Climbers Suck Oxygen through Pipe to Keep Alive on Mt. Everest

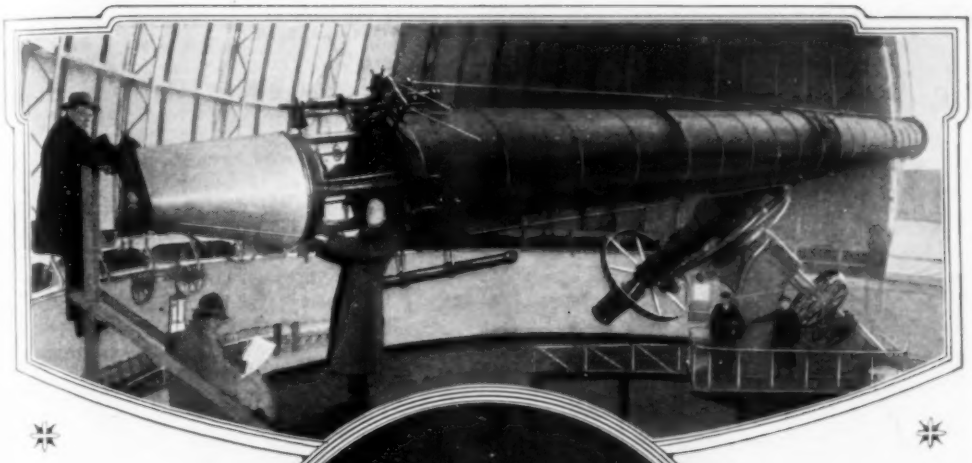
Something of the hardships that the daring explorers who attempted to climb Mt. Everest were compelled to undergo, was forcibly impressed upon the public recently in a motion picture illustrating how the adventurers were dressed and how they acted as they fought their losing fight for the summit. One of the most distinctive parts of the equipment was the oxygen apparatus which the men had to use as they neared the summit. The tanks, weighing twenty-four pounds, were strapped to the back. Connected to them was a length of small rubber tubing through which the climber breathed the life-sustaining gas as he struggled upward. Goggles to protect the eyes from the glare of the sun, canvas coats with knitted helmets for the head and heavy mittens were other essentials of the "armor." The warm clothing was absolutely essential, but at times during midday when the skies were cloudless, the rays of the sun made the heat almost unbearable in the rare atmosphere, the climbers declared. They failed to reach the summit by less than 2,000 feet.

Courtesy, The Sphere

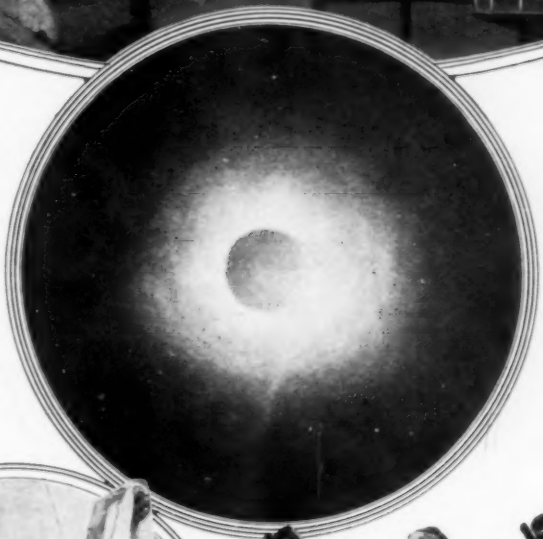
Pose from a Motion-Picture Film Illustrating Oxygen Apparatus and Other Equipment Worn by Mount Everest Climbers

Eclipse Proves Sun's Effect on Radio Reception

The theory that the extreme increase in range of radio transmitters during the night period, as compared to the day, is due to the effect of the sun's rays, producing ionization of the atmosphere during daytime hours, is proved, in the opinion of radio engineers, by experiments conducted during the January eclipse. After checking over the reception results it was generally agreed that the reports had yielded valuable data for consideration in designing future radio receivers. The results attained, however, varied considerably in different localities. Tests made from Schenectady, N. Y., on two wave lengths, before, during and after the eclipse, and recorded at New York on an automatic device, showed no appreciable change. On the other hand, an amateur in Argentina picked up forty-one new stations in the United States, Canada and England and one in Holland during the hours before and after the eclipse. A portable broadcasting outfit set up at Escanaba, Mich., in the path of the total eclipse gave the most complete data on improved reception. It was tested out for three hours each night for three nights prior to the eclipse, and prizes offered for telegrams showing reception from the greatest distance. The results indicated the outfit had an extreme range of 800 miles On the morning of the eclipse a musical program was started at 3 a. m. and continued without interruption until 9 a. m., while the total eclipse passed Escanaba at 8:02 a. m. During the period before and after the eclipse the extreme range of the set increased from about 800 to 1,800 miles, the reports showed. There is always an improvement in distance just as dawn strikes a transmitting set, but, normally, this improvement lasts but a few moments. Telegraphic reports, however, showed that on the eclipse morning, the dawn effect continued steadily to increase.



Scientists Training One of the Great Reflecting Telescopes on the Sun's Eclipse, and a Photograph of the Event Taken from an Army Airplane, One of More Than Twenty-Five Aircraft Which Carried Scientists, Photographers and Reporters High above the Clouds to Witness the Eclipse under Exceptional Conditions; the Picture Shows the Moon at the Exact Moment It Completely Hid the Sun



Two Navy Movie Cameramen, Below, with Special Cameras Which They Used to Photograph the Eclipse from the Top of the Giant Gas Bag of the Dirigible "Los Angeles," and, Lower Left, the Recording Tape of an Automatic Radio Receiver Used to Pick Up a Signal Sent Continuously Before, During and After the Eclipse to Determine Whether the Event Would Affect Radio Reception

Upper and lower left photos copyright, Underwood & Underwood

Machine Gun Kept on Guard in Bank Can Be Fired in Second

A machine gun installed by a bank for use against bandits, is capable of firing forty shots in less than a second and can

Firing Forty Shots in Less Than a Second, This Machine Gun on Guard in a Bank Can Be Quickly Trained on Any Target with Deadly Effect

© U. & U.

tear a hole through an ordinary brick wall. The weapon, of .45-caliber, is mounted on a light tripod at a height of about four feet, from which position it can be handled with ease. Always kept ready at a point commanding the interior of the bank, the gun may be quickly brought to bear on a target. The mounting can be adjusted to any elevation, so the rifle may be readily changed to cover any approach or opening to the room. Its operation is such that even a person untrained in the use of firearms can work the weapon after a short instruction.

Red Tape Yields to White String to Aid Government Economy

Red tape, used by governments from time immemorial to tie up packages of official documents has been abandoned by Uncle Sam in favor of plain white string. The change was made in the interest of economy, ordinary twine being much cheaper than tape. The traditional blue and white striped mail bag also has been banished in favor of plain gray canvas. The striped cloth cost a cent a yard more than the plain color, and the government will save $40,000 a year as a result of the change. The budget bureau, since its foundation under Charles G. Dawes, has eliminated hundreds of money wasters which existed only because they were customary. One of General Dawes' first acts was to standardize the army and navy brooms. He found each service had its own specifications and bought separate supplies. Now the official brooms are interchangeable, reducing the money tied up in warehouse stocks. Weather bureau reports which have been posted in public places for many years, also have been eliminated because the newspapers and radio give the same information without cost to the government.

Finger Lamp Throws Light on Work and Saves Electric Current

For dentists, artists, watch repairers and others in similar occupations or for use in the sick room, a handy electric lamp that is worn on the finger somewhat like a ring, has been invented. It is so shaped that the light is thrown directly upon the work and may be moved about by means of a convenient holder on which a reflector for the lamp also is mounted. A transformer accompanies the outfit so that the lamp may be used with current from a wall socket. It requires but little electricity, is durably incased in metal and besides affording a bright illumination calculated to spare the eyes, does not bother persons near by, a feature that commends its use for patients in a hospital ward.

For the Sick, Finger Lamp Is Found Convenient When Writing, and Spares the Eyes

Airplane with Revolving Wings Flies Vertically or Level

An "autogyrator," which looks something like a helicopter and can land at very slow speed, overcoming one of the chief difficulties of airplanes, has been successfully tested near Madrid. It is built from an old training biplane, which is retained intact, except for the removal of the upper wings and the substitution of four revolving wings, shaped like propeller blades. Unlike the helicopter, in which the power is transmitted direct to the lifting propeller, the revolving wings of the autogyrator are not geared to the engine, but revolve freely in the air like the sails of a windmill. The engine revolves the front propeller in the ordinary way. As the plane starts forward the rush of air sets the revolving wings in motion, and when they have attained a speed of about eighty revolutions a minute they begin to exert a lifting effect. The machine is handled in the air like an ordinary airplane. The chief points claimed in its favor are the low landing speed and the fact that it cannot be stalled in the air. The usual plane must have sufficient speed to permit maneuvering. When its forward movement drops below a certain speed, the plane will go out of control and begin to fall. If it is high enough in the air, the pilot can utilize the falling speed to bring it out of a side slip or tail slip and get under way, but when the trouble occurs near the ground a fatal crash is the usual result.

Four Freely Revolving Wings Replace the Usual Upper Surfaces in This Rebuilt Training Biplane

Wireless Sender for the Unskilled Needs No Knowledge of Code

A simple wireless transmitter with a sixty-mile range, which requires no knowledge of telegraph code and no batteries, has been developed in England, primarily for use on ships' lifeboats. The complete outfit is contained in a cabinet, nineteen by nine by nine inches, and weighs but thirty pounds. A series of rotary contacts, each segment of which represents the Morse signal for a figure or letter, is revolved by turning a crank, and the same crank operates the magneto which generates the sending current. A handful of contact points for the revolving segments is sufficient to give 24,000 code combinations. As long as the handle is turned, the message is repeated over and over. In use on the lifeboat of a wrecked ship, the message could include the SOS call and the boat's longitude and latitude. In addition to the aerial terminal, there are taps from which the masthead light of the boat may be lighted, or radio and light may be worked together. The British Royal air force has adopted the transmitter for use in airplanes.

Three Turrets of Nine Guns and a Stumpy Mast and Bridge Will Break the Sweep of the Long Deck on England's New Battleship-Airplane Carrier

Latest Warships Built to Fight But Not to Run Away

Built without funnels and scarcely any superstructure, with all guns grouped in three turrets forward, and a clear deck space for launching airplanes, two new British superdreadnoughts, the "Nelson" and the "Rodney," now nearing completion, threaten to revolutionize the art of battleship designing. They differ as radically from the fighting ship of today as the present dreadnought does from the sailing frigate of fifty years or more ago. With their nine sixteen-inch guns concentrated forward, they are essentially engines of offense, since it would be practically impossible for them to fight an effective rear-guard battle while running away.

Their unusual appearance will be largely due to the absence of the familiar bridge, chart rooms, deck houses, fire-control platforms and other above-deck structures. Instead of funnels, tubes running aft along the sides will carry away the smoke and gases from the engine room, and increase the ability of the vessel to lay down a smoke screen close to the water.

The new ships are 702 feet long, 158 feet shorter than the thirty-five-knot British battle cruiser "Hood," which was laid down just after the battle of Jutland. They have an extreme breadth of 106 feet and a mean draft of thirty feet. The maximum speed will be only twenty-one knots.

Wire-Basket Trap Catches Animals Alive without Hurting Them

Needless destruction of fur-bearing and other animals is avoided in a humane wire-basket trap that catches the quarry alive without injuring it. There are two strong jaws operated by a spring and trigger, and when open, the trap resembles a small set of metal bedsprings. The trigger releases the sides, which snap together tightly, inclosing the catch in a mesh of steel wire.

Various sizes are made to suit the kind of quarry the trapper is after. Besides preventing damage to the fur and sparing the creatures pain, this trap permits release of the females unharmed, which, of course, is a worth-while practice in view of the growing scarcity of some varieties of fur-bearing animals.

Basket-Ball Player with Protective Mask Which Permits the Wearing of Eyeglasses during Games

Mask Guards Athletes' Eyeglasses from Injury in Games

So players of basket ball and similar sports accustomed to wearing eyeglasses can keep the spectacles on during games, a mask has been designed which guards them from injury. Adjusted over the upper part of the face, the shield does not obstruct the vision nor interfere with the player's action. Being well padded where it comes in contact with the head, the mask resists the weight of a ball or other missile which might strike it. The guard may also be used by those desiring to simply protect their eyes and nose from accident during scrimmages and falls. The protector may be easily formed to fit the head so it cannot annoy the player.

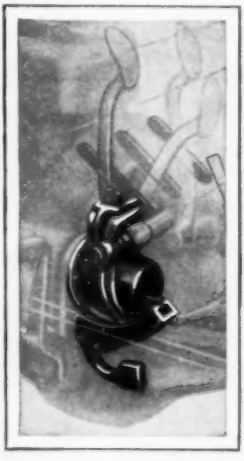
Camera Connected to Cash Drawer Traps Thief by Flashlight

With a camera and a flashlight, a Texas druggist trapped a thief who had been robbing his store at night. The apparatus was connected by a wire to the cash register so that the instant the cash drawer was opened, the flashlight would explode and the shutter of the camera open. The burglar fled, believing that he had been fired upon, not realizing that his picture had been recorded on the photographic plate which, when developed, resulted in his arrest.

Niagara at Night, under the Spell of Searchlights Pouring Out of the Darkness Like an Ever-Breaking Wave to Meet Added Brilliance from Batteries of Electric Rainbows

Neutral Gear Control for Small Car Adds Ease and Safety to Driving

Holding a Ford car in neutral can be done without keeping the foot on the pedal or pulling the emergency brake, by means of an automatic attachment that is put on in place of the metal cup covering the drive on the engine and is entirely concealed under the floorboards. The mechanism consists of a fork which engages the pedal automatically after it is pressed into low gear, returned to high and then put back to the neutral position. A weight on the attachment causes this action without springs or gears, and it is released by simply pressing the pedal in the same manner as when applying the control. Malleable iron, which is claimed to last throughout the life of the car, is the material used for the attachment; it needs no oiling or attention and can be put on in fifteen minutes, as there is no need for boring any new holes.



Magic of Colored Searchlights to Increase Niagara's Beauty

Twenty-four thirty-six-inch floodlights of many hues with a combined brilliance of one and one-third billion candlepower, are being installed at Niagara to transform the cataract into cascades of liquid color when darkness falls. The project is the result of international co-operation between the United States and Canada, and $60,000 has been pledged for the installation and the cost of operation for one year. It is planned to have the falls illuminated four hours nightly and color drills will be given on special occasions, such as national holidays and the birthday anniversaries of famous persons. All the lights are to be located on the Canadian side at a point where the beams will penetrate the fine mists, reach the main bodies of falling water and be sent leaping into the heavens where they will be visible at a distance of seventy-five miles. It is estimated that thirty per cent more light than was used in the installation of 1907 will be employed. Only one man will be needed to operate the battery regularly, and one helper will be sufficient on special occasions. The platform holding the lights will be concealed by shrubs so that the beauty of the surroundings will not be marred.

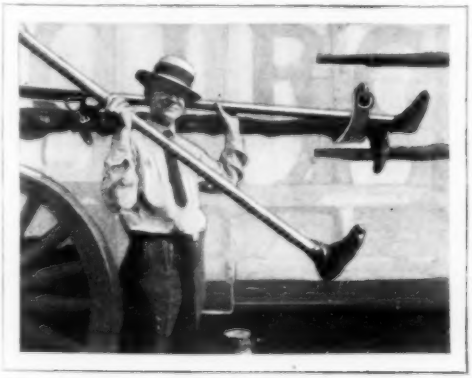
¶Twenty-five tons of air must be drawn into the cylinder of a Diesel engine to burn one ton of oil fuel.

Speed of Shooting Stars Estimated at Forty-Five Miles a Second

Speeds as high as forty-five miles a second are attained by meteors, the "shooting stars" which are drawn into the earth's atmosphere and burn up in a final brief blaze of glory, according to Prof. C. M. Sparrow, of the University of Virginia. The meteors, he says, are small bodies which, entering the upper atmosphere of the earth, are heated to incandescence and remain visible at night until they are completely burned up, or fall to earth. The heights at which they appear lie between fifty and a hundred miles above the earth. At that altitude the atmosphere is believed to be almost pure hydrogen, the gas used in balloons. Hydrogen forms but one ten-thousandth part of the earth's atmosphere at the ground, but being very light, its density diminishes so slowly with increasing height as to outlast the heavier nitrogen and oxygen.

Clown Stilts Have Feet of Sand to Make Walking Easy

Stilts usually employed by circus clowns to give them gigantic stature during their antics in the rings, have feet of sand to aid the performer in walking and to maintain his balance. The poles are of stout hickory flattened and widened at the tops to fit the wearer's thighs and fitted with straps to hold them in position. Toward the bottom, the props are rounded and tapered, ending in soft shoes filled with coarse sand which are fastened on the sticks so that the heels support the points.



Stilts Used by Circus Clowns to Make "Legs" Which Give Them Gigantic Statures

Wide trousers or other apparel cover the stilts for their full length, and the clowns appear to walk on their heels.

Deaf Hear by Touch on Telephone Held in the Hand

With a telephone whose receiver transmits vibrations to the sensitive palm of

Transmitter by Which Spoken Words Are Converted to Vibrations in the Receiver Above

the hand, it is believed deaf persons can be greatly aided in reading spoken messages through the sense of touch. Words spoken into the mouthpiece of the instrument set up a series of pulsations in the delicate receiver that correspond to the sounds of the voice. These result in a sort of code which the "hearer" may easily learn. Though surrounded by loud noises and other heavy vibrations, the person, while lightly gripping the receiver, can readily distinguish words and sentences coming over the telephone without interference from disturbances and sounds originating on the outside.

Cathedral Saved by Deep-Sea Diver Working Five Years in Dark

One of the most heroic accomplishments in the annals of engineering has come to light in the account of a diver who, working single-handed and in almost complete darkness, saved Winchester cathedral in England by renewing its foundations. The task consumed most of five and one-half years and was performed several feet below the surface, in slimy soil and water. The building was foundering because it rested only on an eight-foot layer of wet peat. The diver removed this material in sections, substituting concrete which he himself brought down and laid on a firm stratum of gravel, flint and chalk below the peat formation.

Density of Fog Shown by Gauge That Marks Dots on Card

One of the instruments in constant use at the weather bureau station in Kensington,

Fog Gauge in Operation, Air from Outdoors Being Drawn In Through Window Tube

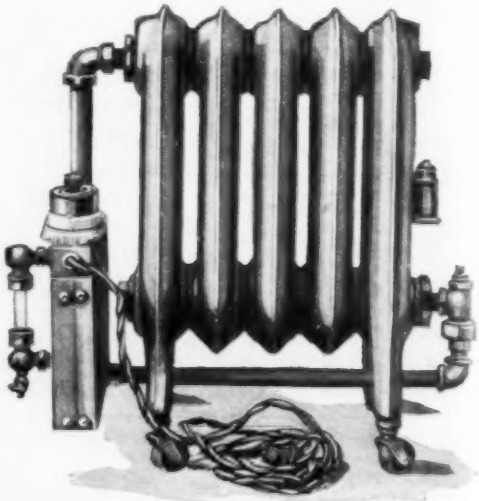
London, is a device for measuring the density of fogs. Vapor-laden air is drawn in through a tube inserted in a window and as it passes through the recording apparatus, a scale of dots registered on a card indicates the degree of thickness of the mist. The spent moisture is allowed to pass out through a waste tube, and by examination of the residue left within the instrument, it is possible to measure the amount of foreign matter that is present in the outside air.

Herds of Wild Animals on Increase through Protection of Parks

While big and small game is becoming more scarce each year in almost every part of the country, herds of wild animals are reported on the increase in areas that enjoy the protection of the national parks. H. S. Harris, warden and trail rider in Jasper Park in Canada, reports that a herd of 100 elk brought from the Yellowstone in 1919 has now increased to 700; deer can be counted by the thousand and are seen every night in the streets of Jasper village within 100 yards of switch engines, and over 9,000 mountain sheep have been counted by a system that allows for duplication. Caribou are now found in most of the valleys, and bears have become so numerous that they are said to be a positive nuisance, breaking into wardens' cabins frequently and stealing provisions. The animals seem to realize quickly that the parks are barred to hunters and migrate to these sanctuaries from great distances.

Portable Electric Steam Radiator Operates from a Light Socket

Combining portability and the convenience of mere attachment to an ordinary electric-light socket, an electrically heated steam radiator devised by a western inventor, appears to have genuine practical value to the home owner. In localities where current is not expensive, it is claimed that the radiator will heat rooms, and even a whole house, at a price within the means of the average wage earner. Steam is generated in a small container made of non-crumbling and heat-resisting clay wound with special wiring to heat a water jacket at one side of the radiator. In about fifteen minutes, the contents in the radiator can be warmed to a temperature of 214 degrees Fahrenheit, it is said. On the other side there is a vacuum attachment which circulates the water by drawing it out of the radiator coils and returning it to the jacket.



With Water Jacket, Cord and Switch, Electric Radiator Rests on Rollers for Easy Moving

Radio in the Canadian Rockies

By LEWIS R. FREEMAN

THERE are two fields of adventurous romance into which the pioneer in the development of such modern inventions as the telegraph, telephone, airplane or radio may push his questing way. The first is that of technical improvement. This is essentially the field of trained experts—the Bells, Wrights and Marconis.

The other field might be called that of operative experiment, that in which a new instrument is tried out under novel conditions and in the face of difficulties possibly hitherto reckoned as prohibitive. Here, also, the technical expert has the advantage, but that there are occasional opportunities for the novice to rush in where better trained men have not had the chance to tread, and that such excursions have results, is well proved by my own experiences.

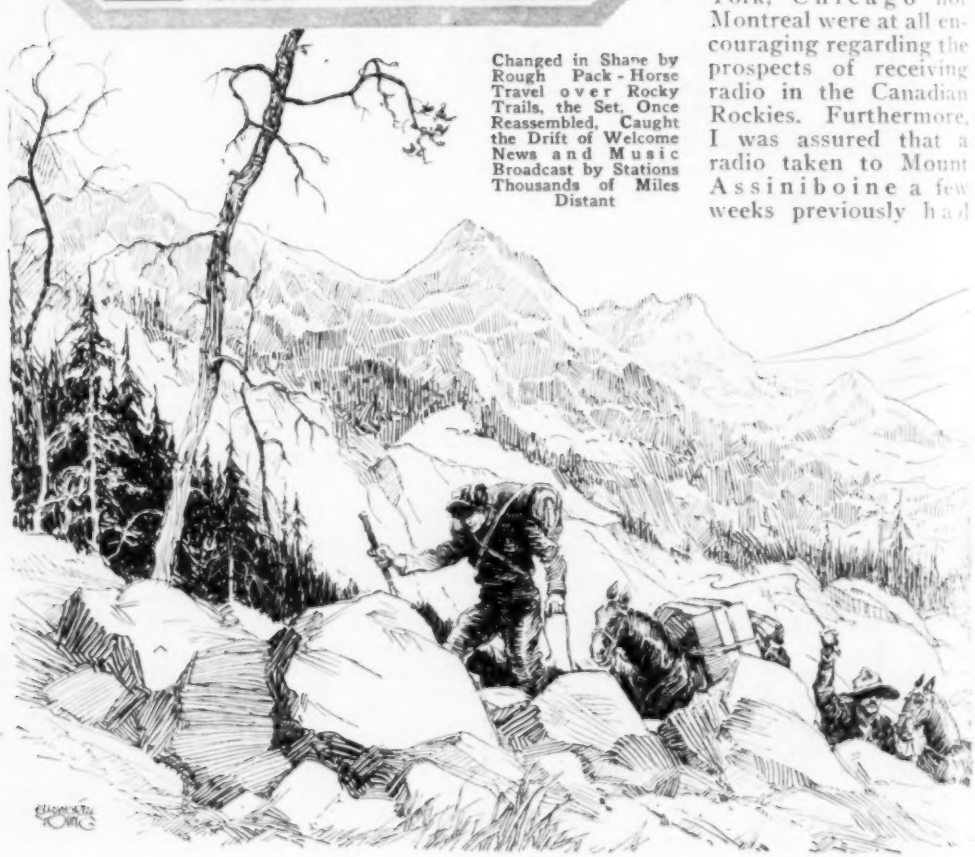
In the summer of 1923, I accompanied the geological survey party through the gorge of the Grand canyon. Experts had been claiming that it would be impossible to receive radio in a deep sheer-walled gorge, and here was an expedition about to endeavor to pass through the most abruptly boxed of all the world's great gorges. A receiving radio set, specially assembled with dry batteries in a waterproof box, was provided by government experts. The result of the experiment was to establish the entire feasibility of radio reception in the deepest of chasms.

It was our Grand canyon set which disclosed to me for the first time the hitherto unguessed possibilities of the radio for the members of an expedition completely cut off for weeks, or even months, from other communication. Daily news was the greatest boon, with the pleasure of song and music a close second. It was for this reason that I proposed the inclusion of a radio when I was asked, early in the summer of 1924, to join an expedition to explore the barely known region along the Continental Divide called the Columbia ice field.

My relations with the radio set carried through the Grand canyon were confined to stowing the stout yellow box containing it in the forward compartment of my boat and doing my best to keep it from being dumped out into a rapid. Of course, I listened in once the ether had been coaxed into giving up its secrets, but of

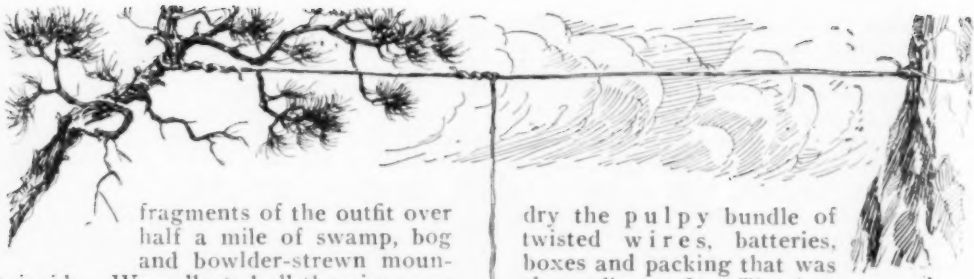
Changed in Shape by Rough Pack-Horse Travel over Rocky Trails, the Set, Once Reassembled, Caught the Drift of Welcome News and Music Broadcast by Stations Thousands of Miles Distant

the technical side of radio I learned nothing. In spite of this, our Canadian Rockies expedition was destined to prove up the radio receptivity of a very large area which had come to be considered as "dead," to say nothing of giving such a convincing demonstration of the "foolproofness" and durability of present-day radio sets. The little four-tube set used did not weigh over five or six pounds. Wire and batteries added possibly forty pounds more weight. An outside aerial instead of a loop was decided upon because of its portability, durability and receptivity. Neither New York, Chicago nor Montreal were at all encouraging regarding the prospects of receiving radio in the Canadian Rockies. Furthermore, I was assured that a radio taken to Mount Assiniboine a few weeks previously had



not picked up a single station. Nevertheless, we had a local Banff electrician connect the batteries and tie them into a fairly compact sort of block which fitted into the largest compartment of a cedar pack box for the journey over the Rockies. The radio set itself was wedged into a smaller compartment, while still another received spare tubes and other odds and ends. Spare batteries and wire for antennæ were carried in other packs.

Now of all known methods of transport that by pack horse or pack mule is beyond all comparison the roughest and most destructive. Man back, dog sled, elephant, camel, boat, auto truck or aerial tramway are as nothing compared to it in power to do harm. The crushing with lash ropes and the jolting even along an open trail are punishing beyond description. When, in addition, the pack train is headed into uncut timber, deadfalls, bogs and bowlders, the effect may be imagined. Of course, the well-padded pack box was constructed to meet just such conditions, and that is why it only changed shape instead of flying apart the first time the hulking cayuse carrying it was brought up sharp by his pack jamming between two close-growing pines. The case stood that first crash astonishingly well; also the buffetings of a somersaulting roll down through the shattered rocks. It was even recognizable as a box after it had been on the underside of the pack for ten minutes while its bearer sunk to his ears in a bottomless stretch of muskeg. But when a chafed lash rope parted and let the casket slide down and dangle against "Jerry's" heels, the moment had come when it was no longer possible to follow the expert's injunction as to keeping the set and batteries hooked up exactly as he had left them. Even finding the component parts was hard enough, for "Jerry" had proved his qualifications as a radio horse by "broadcasting" the various



fragments of the outfit over half a mile of swamp, bog and bowlder-strewn mountainside. We collected all the pieces we could find and roped them up in the surviving fragments of their carrying case. That they could ever be made to perform their original functions again, no one but our optimistic French-Canadian cook dreamed. When the whole pack train was rolled while fording the torrents of the Saskatchewan and Alexandra, nothing came in for a more prolonged soaking than the radio.

It was in the beautiful Castleguard valley, 8,000 feet above sea level and on the very verge of the great Columbia ice field, that we first rested from our steady grind of trail work, and pitched a four-day camp. Here, for the first time, we had a chance to disentangle, clean and dry the pulpy bundle of twisted wires, batteries, boxes and packing that was the radio outfit. The box itself, with not a right angle left, gave forth a noise like a child's rattle, from the screws, switches and various odds and ends shaking about inside of it. Once it was trued up and the knick-knacks restored to place, however, it was just about the same as ever, at least so far as looks were concerned. The tubes (there were eight of them including four spares) appeared a total loss. While the outer glass of every one of them, protected by cotton-batting wrappings and a fiber case from breakage, was unshattered, a telltale tinkle from the inside told of something awry.

It was at this juncture that Ule La-Casse, the cook, unearthing a book of

Two Holes for the Headphones Were Cut in an Old Tin Can; Another Can Furnished a Stand, and the Camp Had a Real Loud Speaker!

The World Came to Visit the Explorers by Way of the Little Black Radio Box. They Valued Almost as Highly as the Food Stores

directions in the mud at the bottom of the pack box, made the proposal that we try to restore the radio to life. There was a diagram showing the proper hook-up, and we already had directions for putting up the aerial. If by any chance the tubes and the batteries still retained a kick, who could say that we should not be bringing the outside world to our tepee door inside of an hour. As it is always good policy to humor a camp cook, we let him have his way.

The batteries spat forth strong, vital sparks, but the real surprise came when each of the tubes, tried out one after the other, responded with a bright red glow to the circulation of the current. Just what was the loose hardware clinking round inside of them we never did learn, but probably a fragment of glass from the collar at the base of the filament.

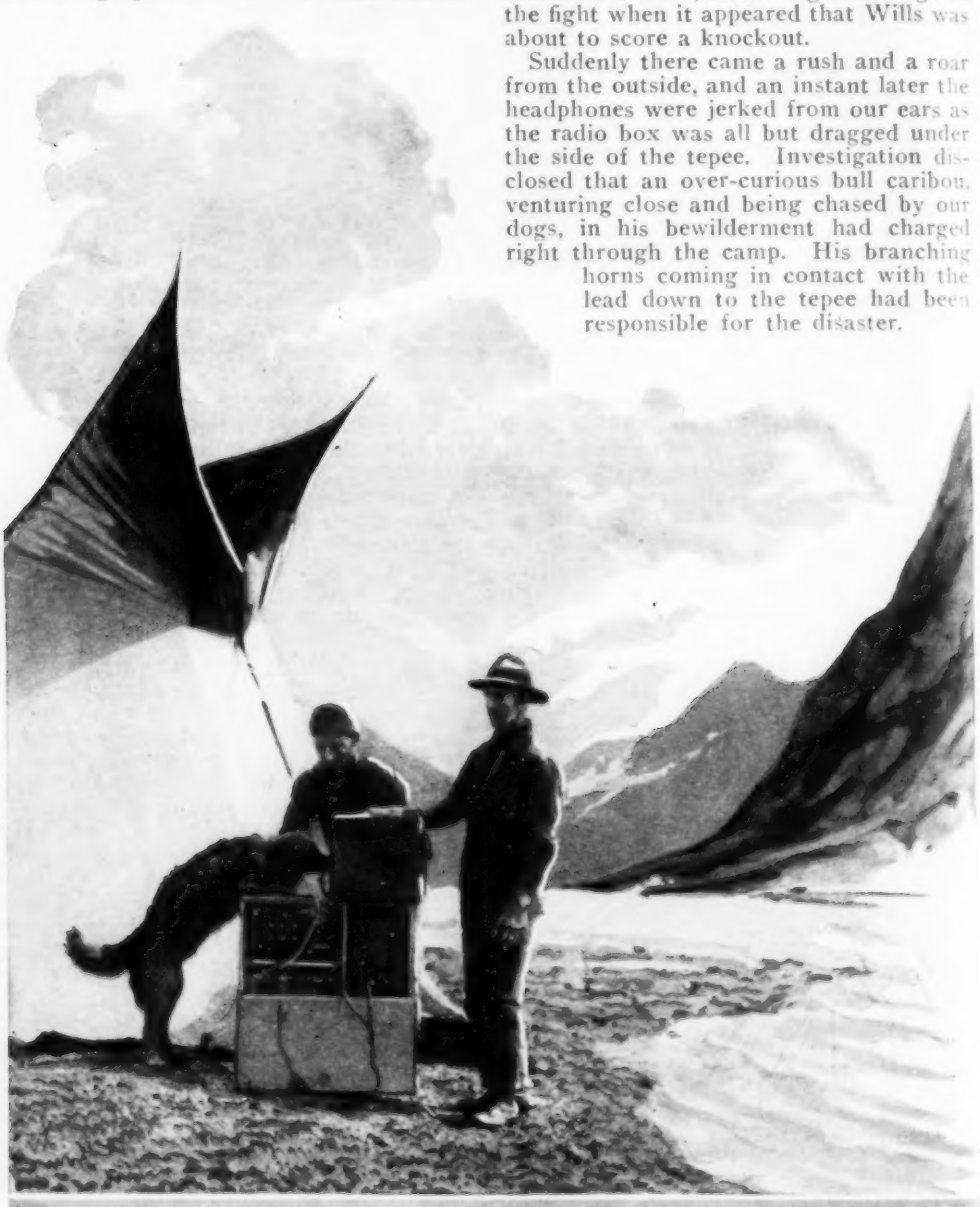
The aerial, by dint of rough climbing and some clever lassoolike casting of loops of the wire, was finally strung between a ledge of rocks and the last scraggly pine at the timberline. A jiggering of dials and switches along toward the end of the afternoon seemed to reveal restless stirrings of the ether, but not all our cunning could resolve it into anything more coherent than clangs and howls. Further study of the book revealed the various units of our wiring system as the probable seat of trouble. The radio had been connected to the north rather than the south end of the antenna, while a loose bowknot of insulated wire could hardly have been expected to give as satisfactory outlet for the lead as the soldered joint recommended by the book. All the noises of a busy, booming world seemed to be lying in wait to swoop upon our quiet Alpine valley when reconditioning was complete and we put on the headphones and started jiggering the dials again. With many stations appearing to want to get to us at once, and with scant cunning of hand or ear in the matter of tuning in or tuning out, it was slow work reducing the chaos to a semblance of order and making the clamoring voices take their turn. The long northern twilight was over and darkness descending upon the ice-bound valley before a plaintive ballad in a cracked soprano was heard, announced as being broadcast by an Oklahoma City station "for the benefit of the auto campers." Following directions still more carefully in restringing the aerial the next afternoon, we were rewarded by picking up Calgary, with a score of stations scattered between Pittsburgh and Los Angeles before it was dark at 8:30. Quality and strength improved after nightfall.

Bothered by snow flurries again, we changed the set-up next day so that the lead ran down into the tepee and we could listen in from the comparative comfort of

our bed rolls and with the light and warmth of a crackling pitch-pine fire. And here it was, for the final two months of the expedition, that the world came to visit us every night by way of the little black box which we had come so near to throwing into complete discard.

Without giving the lengthy list of stations which we had at one time or another, I may say that these included a majority of the high-power ones east of the Mississippi, others as far south as Baton Rouge, high and medium-power stations in California, and practically everything in the Pacific northwest, British Columbia and Alberta. Hastings, Nebr., we picked up first in a rebroadcasting of the Wills-Firpo fight as described from the ringside. The last round of this contest we lost as the consequence of as queer an accident as ever befell a radio. We were clustered around the radio, harkening to a stage of the fight when it appeared that Wills was about to score a knockout.

Suddenly there came a rush and a roar from the outside, and an instant later the headphones were jerked from our ears as the radio box was all but dragged under the side of the tepee. Investigation disclosed that an over-curious bull caribou, venturing close and being chased by our dogs, in his bewilderment had charged right through the camp. His branching horns coming in contact with the lead down to the tepee had been responsible for the disaster.



Model Farm Saves Miles of Steps

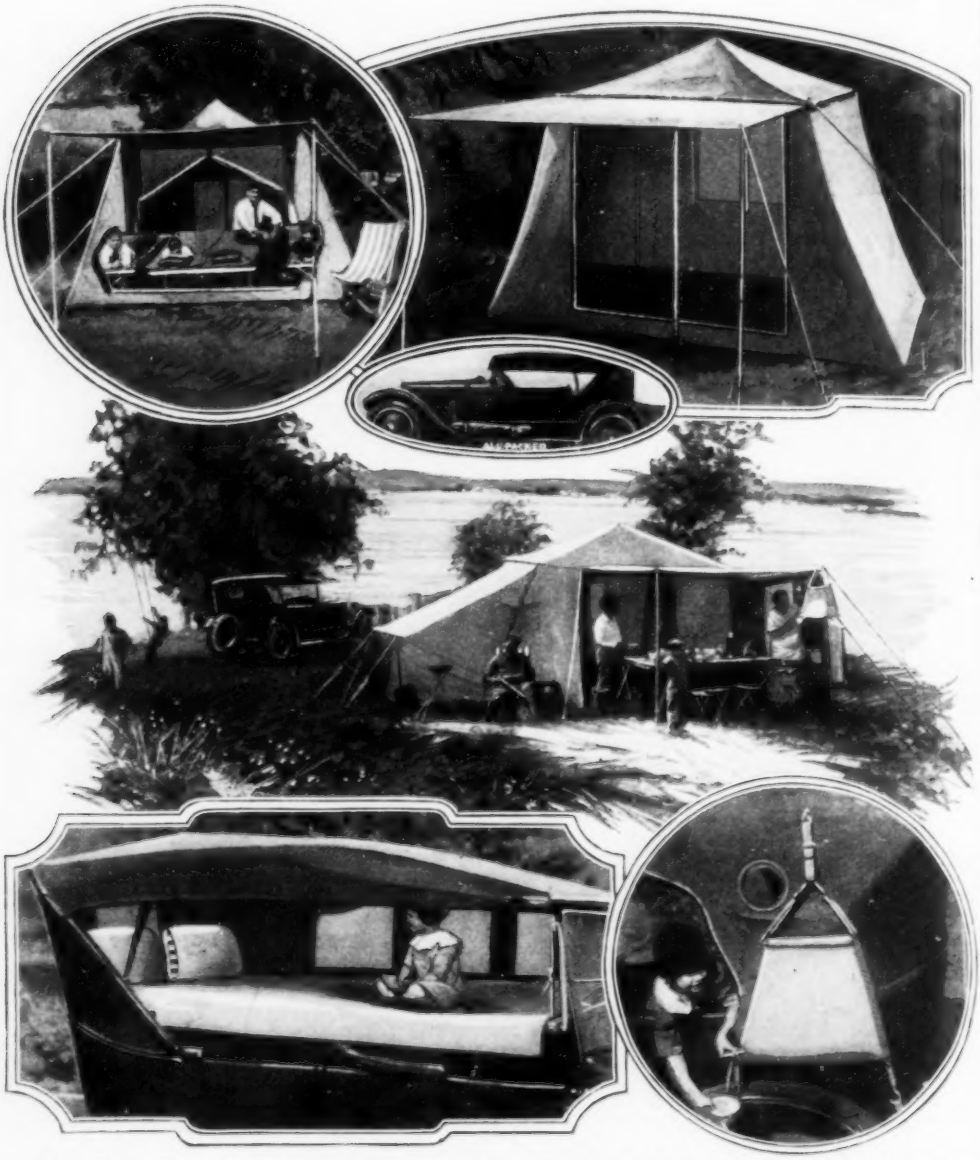
Designed to eliminate miles of wasted steps, a complete model farm has been designed and built to scale by students at the Nebraska college of agriculture. Working on the theory that every farm is a factory, to which labor-saving schemes should be applied, the students analyzed the ordinary chores of the farmer, grouped them in the order in which they should be performed, and then placed their model buildings accordingly. Fitted to the prairie territory, where the prevailing wind is south and southwest in summer and north and northwest in winter, the farm buildings are placed east of the house, in order that odors will be carried away from the farm home. On the other side, the orchard and a windbreak of trees are arranged to furnish protection from winter winds. Each barn is so placed as to form a windbreak for the adjoining yard. The buildings include a barn, silo, cattle and hog sheds, water tank, granary, implement shed, hay shed and poultry house. In the morning when the farmer leaves the house, he goes first to the barn, tends his horses and cattle, milks, separates the cream and feeds the calves. Then he carries the skim milk to the hogs, passes on to the granary to feed the fattening porkers, and in returning, passes the hay shed and feeds the cattle and poultry. Next he steps into the milk room and gets his cream, returning to the house. Coming in through the lower gate by the hay shed at evening, his course to the barn leads past all the buildings and almost all his chores can be completed while the team is drinking and going on to the barn. On one farm all the chores were done by walking only 750 feet.

Skaters on Stilts Can Cover Great Distances with Fewer Strokes and Maintain High Speeds with Less Effort than Required by Ordinary Blades

Skater on Stilts Glides over Ice in Novel Stunts of Speed

With skate runners attached to stilts, a performer on an ice rink at a Switzerland resort accomplishes feats of grace and speed rivaling those possible with the ordinary blades. Raised almost two feet from the ground, the skater easily swings into long strokes or describes fancy flourishes in small space. For racing, the extensions permit lengthy strides and great rates of speed. The blades which are of the usual size are fastened to shoe-shaped supports while a firmly constructed step holds the performer's foot. Straps keep the standards secured to the skater's legs, leaving his arms free for balancing.

PORTABLE COMFORTS MAKE CAMPS HOMELIKE



Above, Roomy Tent without Center Pole Which May Be Rolled into Small Parcel; Center, Camp Home with Portable Dining Equipment; Below, Bed Swung in Automobile and an Iceless Water Cooler

Motorists on tours, overland travelers and campers may partake of conveniences rivaling those found in modern homes without adding greatly to the amount of luggage carried or labor necessary to set up such accessories. Roomy shelter to suit almost every need may be provided by a sturdy tent which can be rolled up in a few minutes and packed in a small space on the running board of an automobile. Readily handled by one man and proof against rains and insects, the canvas house is equipped with a doorway awning as added protection against the sun. The usual center pole is absent, making it more adaptable than ordinary types for the placing of furnishings. A ventilating window of special material, which can be seen through only from the inside, is provided in one wall, while the

floor is of flexible, waterproof fabric and can be quickly cleaned with a sponge. To afford fresh foods and cool water, a combined iceless refrigerator and water container, which operates on the principle of the desert bag of the Orient, is designed to be fastened at the side of an automobile while traveling, or installed in the camp where it can be used as a reservoir or hung overhead and fitted with a shower attachment. Constructed like a canvas bucket, the bag has a faucet at the bottom and can be easily filled or cleaned. For overnight comfort, there is a folding bed which can be hung on the inside of a touring car or put up near the ground at the side. Made to fit almost any make of automobile, it can be placed in position in a short time with the adjustment of but two straps. The frame, made of hardwood, is easily unfolded and assembled, and insures a smooth and comfortable bed that will not sag.

Candle in Lamp Is Floated in Water to Prevent Fire and Stains

Most of the disadvantages of the ordinary tallow candle are said to be avoided in a lamp-shaped holder which has a shade and a water-filled tube, keeping the stick in an upright position and catching the drippings. As the grease is lighter than water, the candle automatically rises as it is consumed and it can be burned down to the thinness of a wafer before a new one is required. The shade prevents the flame from flickering and gives the lamp an attractive appearance. Besides eliminating the stains from the drippings, the holder is safer than the ordinary kind, as the water would be likely to extinguish the blaze in case the lamp should be overturned by accident.

Prints of Monkeys' Hands Compared with Criminals' Fingermarks

In an experiment to determine fingerprint characteristics common to criminals and monkeys, experts at the San Diego, Calif., zoo are taking impressions of the animals' hands for comparison with prints in the files of the police department of that city. The tests are also said to be for the purpose of studying various evolutionary theories. After the investigations, tail prints of the animals are added to the hand marks and distributed to other zoos in remote parts of the country for comparison with those of similar species held in captivity to learn the effects of surroundings and climates on the various kinds of monkeys.

Fingerprint Experts Taking an Impression of a Chimpanzee's Hand While Its Trainer Talks to the Animal to Distract Its Attention

Theater Lends Umbrellas to Patrons Waiting in Rain for Tickets

When showers threaten to disperse crowds waiting in line for tickets at a theater in Portland, Oreg., the management sends a bevy of "usherettes" to the rescue with umbrellas which they distribute and collect later at the entrance. The name of the theater, lettered on all sides of the umbrellas, forms an effective advertising device as well as protection for the property, and the plan has proved an efficient way to prevent decrease in box-office receipts on stormy days.

Dard Hunter's Thatched-Roof Paper Mill, with Its Old Water Wheel for Power, from an Etching in Hunter's Book on Old Paper Making

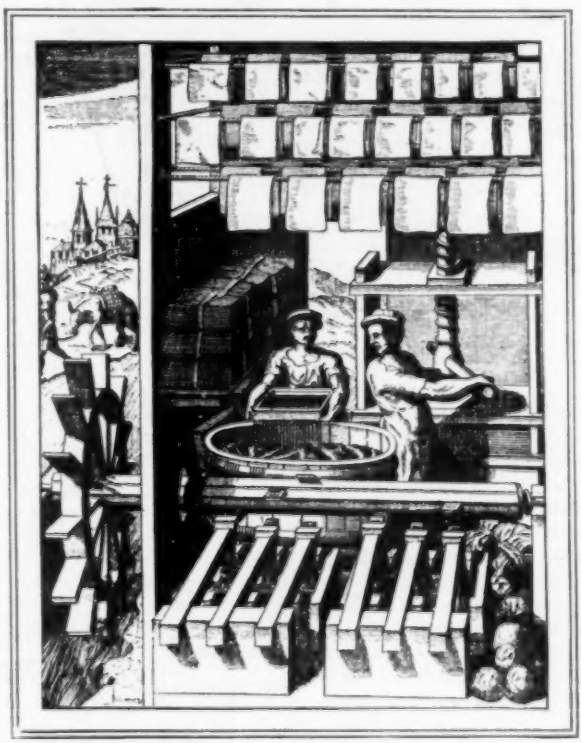
Author Makes Paper and Prints Own Books

Art of Printing and Paper Making, as Practiced in Days of Gutenberg and Caxton, Is Revived by Ohioan in Unique Plant

IN the National Museum at Washington two large cases are filled with punches, matrices, tools, type molds, handmade paper molds and handmade type. They are the nation's permanent record of the world's most unusual bookmaking venture—Dard Hunter's one-man book plant at Chillicothe, Ohio.

Hunter's work stands alone because he is the only man in the history of bookmaking who has produced volumes printed on paper which he made with his own hands and from type which he not only designed, but manufactured unaided. From the writing of the book to the last step in its binding no hand but Hunter's touches any of the materials which go into its make-up.

From the cotton and linen rags, beaten to pulp by power from a water wheel of his own construction, in the paper mill which he built with his own hands, Hunter produces the finest of antique hand-laid paper, in molds of his own designing and construction. The watermarks which he designed are works of art and are highly prized not only by book collectors in this country but by great libraries and museums abroad. In his printshop he picks the type from the cases and sets his own manuscripts. The type he designed and then cast in molds of his own construction, was made with tools which he likewise manufactured. Even the metal in which the type is cast is not the common alloy which may be purchased from type founders. Instead he bought copper, antimony, steel and lead and mixed his own alloy.



Making Paper by Hand, from a Medieval Print, Showing Methods Used by First Bookmakers

With the type locked in the page forms, Hunter proceeds to print his books on an ancient hand-operated press, and then binds them by hand. His editions average 200 copies each and are so eagerly sought by book lovers, museums and collectors that they command the highest premium of any modern books, even outranking the famous Kelmscott books which were produced in the workshop of William Morris, the great English reviver of the art of fine printing.

The history of Dard Hunter's workshop goes back many years to days when he was a designer of books for the late Elbert Hubbard at the Roycroft shop in East Aurora, N. Y. Hubbard's roycrofters were an aggregation of specialists, each doing one part of the work. Hunter decided that the books lacked individuality because so many hands had a part in their making, so he decided to do the whole work himself. Hubbard's handmade paper was imported from Europe, but Hunter went direct to Italy and studied the art in a mill where hand-laid paper had been made for centuries. Next he went to Vienna and studied type design with the late Rudolph von Larisch and the art of bookmaking in the graphical institute and the artcrafts school. Then he entered the Royal Techni-

Punches, Ladle and Metal Used by Hunter in Making Type

cal college of Finsbury, London, and studied toolmaking with England's foremost metal worker, Alexander Fisher.

Finally, prepared for his venture, he returned to his old home at Chillicothe, where he lives on a hilltop overlooking the town, his residence being a replica of the Villa Centinale, in Tuscany. It was built by a German political refugee about 1850.

With his own hands he built a paper mill of half-timbered construction, modeled after an old cottage of Devonshire, Eng. He even grew the wheat from which the straw for the thatch roof came. The miniature mill he equipped with paper-making appliances which he had found in an antiquated paper mill at Wiltshire, Eng., which had not been used since the invention of the paper machine more than a hundred years ago.

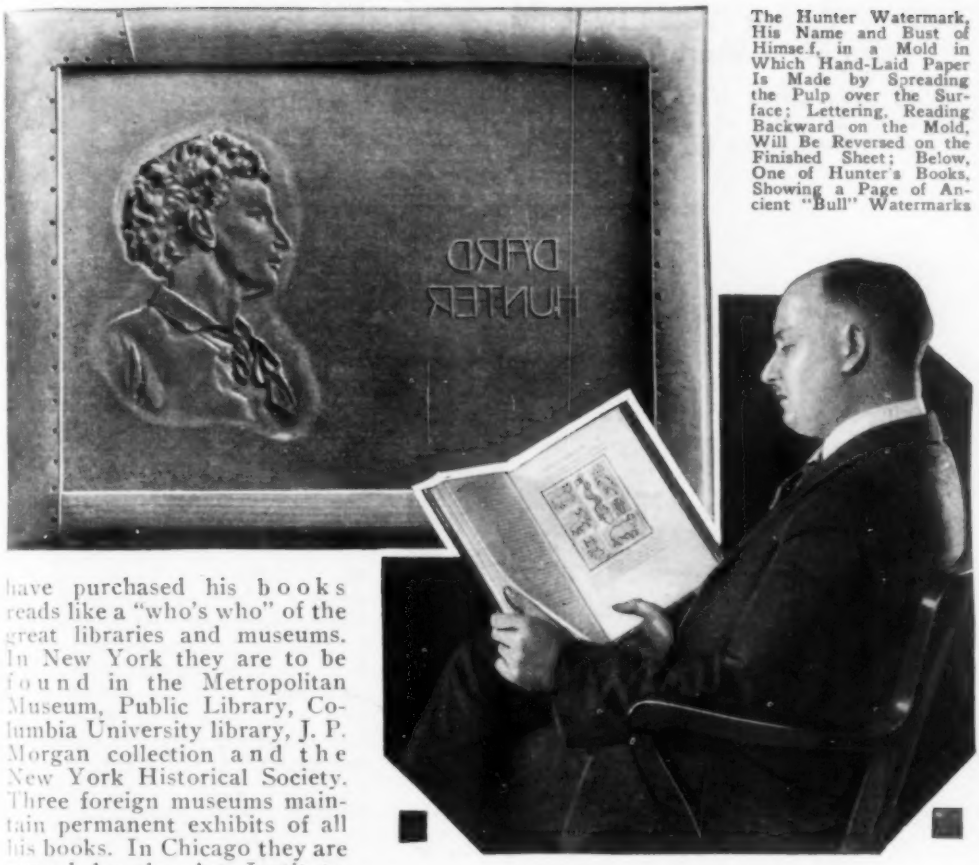
With the help of power from his creaky wooden water wheel he began making paper, turning out about 200 sheets a day, each sheet being produced from pulp hand laid in molds of his own design. When there was no water to turn the wheel, he turned to toolmaking, and with his tools constructed type molds and matrices, using his own type designs for the latter. His methods followed those of the first type makers, the punches being cut by hand and stamped into bars of copper, which formed the matrices into which the type metal was poured.

The type making alone occupied three years, and before he had enough type and paper for his first edition of 200 copies, five years had slipped by, yet when that first book was off the press, in 1915, he sold it at $5 a copy. The same book now brings as high as $75 a copy. With the same type and style of paper, he produced a second book in 1917, and in 1923 brought out his famous "Old-Paper Making," a quarto volume of more than 200 pages. The edition, of 175 copies, was two years in the press. The text explains in a comprehensive manner the methods of the old paper makers, with many illustrations in black and white as well as a great number in color—all produced in his one-man shop. The list of clients who

Dard Hunter at His Old Hand Press

Type Mold and Matrix, and Some "Homemade" Cast Type

Part of a Font Made by Hunter



The Hunter Watermark, His Name and Bust of Himself, in a Mold in Which Hand-Laid Paper Is Made by Spreading the Pulp over the Surface; Lettering, Reading Backward on the Mold, Will Be Reversed on the Finished Sheet; Below, One of Hunter's Books, Showing a Page of Ancient "Bull" Watermarks

have purchased his books reads like a "who's who" of the great libraries and museums. In New York they are to be found in the Metropolitan Museum, Public Library, Columbia University library, J. P. Morgan collection and the New York Historical Society. Three foreign museums maintain permanent exhibits of all his books. In Chicago they are owned by the Art Institute, Crerar and Newberry libraries. Nearly all state libraries and the art institutes of San Francisco and other cities have taken copies.

"Typography has always been of vital interest to me," Hunter says. "I was reared in the midst of paper, type and ink. My earliest recollection is watching my father set type, and print on an old Washington hand press. He had a great love for the printing of the early craftsmen, which he said had never been excelled; it was his contention that modern book printers should follow in their footsteps.

"For twenty years I labored to get the quality of old typography into books that I was producing. I used the so-called handmade paper from Italy, my type was of special design, and the printing was executed with care. But my books always lacked the charm of the old volumes. I have seen through the press upward of 200 different books, but none of them ever pleased me. They were just so much paper with a type impression—that was all.

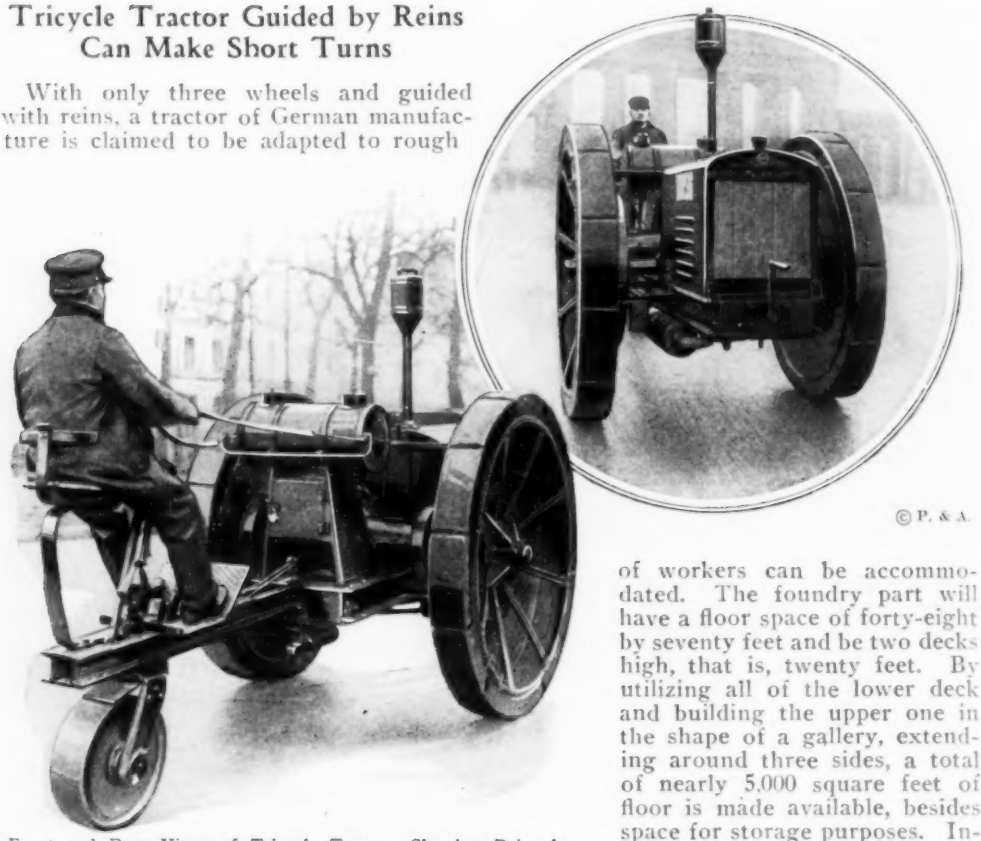
"The Italian book printers of the fifteenth and sixteenth centuries have never been excelled. Their paper, even after 400 years, shows a richness in tone and texture which the modern paper makers have never equaled. The type possesses a freedom of stroke unknown today.

"The old books from the presses of Aldus and Nicolas Jenson haunted me. Why could I not, in this age, produce as fine typography as these fifteenth-century artisans? I determined to learn their processes."

A new book, finished during the last year, entitled "The Literature of Papermaking — 1390–1800," draws extensively upon his library of early books and prints on the subject of paper making, said to be the finest private collection in the world. His library and workshop are in one, a lofty apartment in his home, with a balcony on four sides. Here he has his old hand presses, fonts of type, and hung from the ceiling rafters, are rows and rows of sheets of handmade paper, drying and seasoning. The process of aging takes several years before the paper is ready for use.

Tricycle Tractor Guided by Reins Can Make Short Turns

With only three wheels and guided with reins, a tractor of German manufacture is claimed to be adapted to rough ground and can make exceedingly short turns. Each of the large front wheels is independently geared and can be stopped or started by pulling leather straps attached to a frame in front and held by the driver. By stopping one wheel and leaving the other one in power, the tractor, aided by the small rear wheel which is fixed in a pivot, can turn abruptly about. The big drivers have sectional tires for gripping the surface.



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Front and Rear Views of Tricycle Tractor, Showing Reins by Which Driving Wheels Are Regulated

Seagoing Foundry for U. S. Navy to Repair Ships on Voyages

Practical foundry service for ships at sea, including major repair and replacement castings, is to be furnished by a floating foundry designed for the navy. It will be one of a group, the "works" of a fleet when in motion or at rest. The ship is to be more than 400 feet long with a beam of seventy feet and 10,000 tons' displacement. Many smaller shops will be housed on the ship, and a large company of workers can be accommodated. The foundry part will have a floor space of forty-eight by seventy feet and be two decks high, that is, twenty feet. By utilizing all of the lower deck and building the upper one in the shape of a gallery, extending around three sides, a total of nearly 5,000 square feet of floor is made available, besides space for storage purposes. Included in the melting equipment, are four 700-pound oil-burning crucible furnaces, a three and one-half and a one-ton cupola, all of which are located on the third deck.

Collapsible Holder for Cigarets Fits into Watch-Charm Case

A collapsible cigaret holder, which is two and a quarter inches long when extended and folds up into a small case that may be worn as a watch charm, has been placed on the market. The carrier is about an inch long, is designed after the pattern of an acorn and has a screw top.

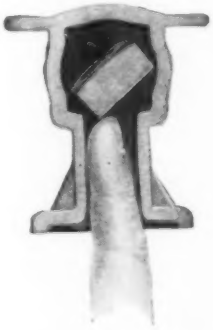
Cigaret Case Extended, and Acorn-Shaped Carrier Which Is Worn as Watch Charm

Tunnel over Thirteen Miles Long Pierces Mountains for Power

Thirteen and one half miles long, fifteen feet in diameter and costing approximately $17,000,000, the Florence Lake tunnel, piercing the granite of a section of the high Sierras in California, engineers estimate, will provide electricity enough for more than 200,000 homes, pump water to 620,000 acres of farm land and furnish driving power for 5,000 factories. More than five years have been spent on its construction. It is the first of a series of similar tunnels that will have a total length of more than eighty miles and cost about $375,000,000. One hundred miles from any large town and marooned much of the time by storms, the workers were organized into permanent camps and "grew up" with the job. They bought stock in the company, schools were started for their children, dog teams brought in regular mails, there were daily motion-picture shows and hot meals were served to the diggers far back in the tunnel on specially equipped luncheon cars. Eighteen cook houses with a capacity of 6,000,000 meals a year were required.

Anchor for Fixing Bolts in Concrete Holds Nut in Steel Slot

For attaching shaft hangers, partitions or other objects to concrete, a steel anchor with a slot and hollow chamber for holding the bolt nut has been devised. It is imbedded in the grout by attaching it to the forms and the insert is so shaped that the nut can be put in place with the finger. The bolt is then introduced and screwed up tight. A shoulder upon which the nut rests, prevents it from becoming loose or twisting, and additional strength is given to the support by a top flange on the anchor spreading into the concrete. No nails or wire are needed to fix the insert in place, and the use of a steel washer prevents the bolt from sticking. The accessory eliminates the necessity of boring or drilling holes in the concrete and is said to afford a stronger grip than is possible with blocks of wood.



Magnifier for Long or Short Range Is Aid to Weak-Sighted

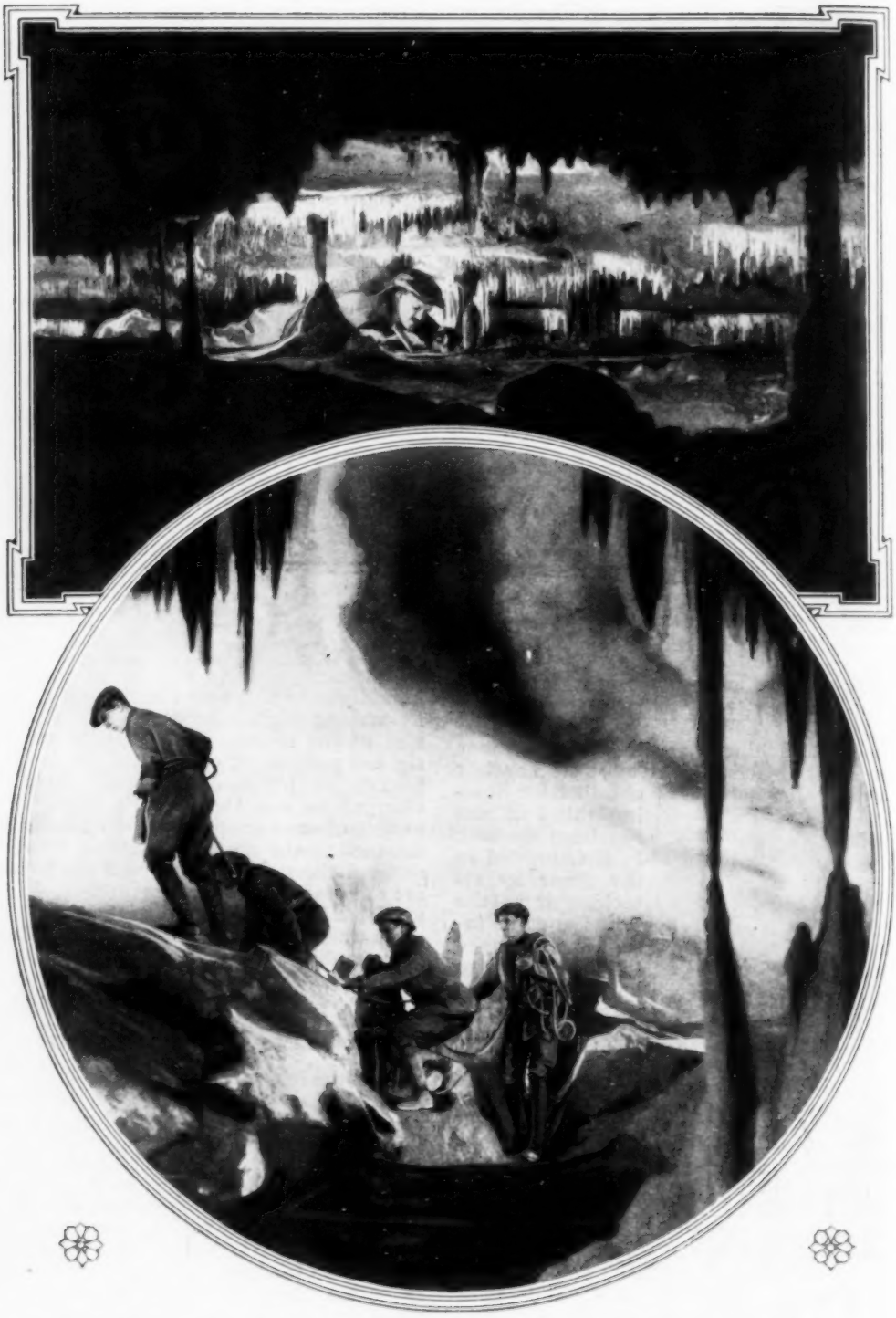
A small magnifying glass with a telescope attachment can be used for either

Telescope Magnifier Attached to Head Clip, for Use by Weak-Sighted Person in Reading

long-distance views or for close-up work by making slight alterations in the position of the lenses. As an aid to weak-sighted persons, it can be carried in the pocket or purse and can be quickly changed to suit the owner's need. To permit of easy support, a loop handle is fastened to the side and to this a bracket or head clip may be attached if the hands are to be left free for other work. A slow-motion adjustment sets the instrument in accurate focus, and a chamber for holding minute objects can be easily inserted.

Autos Use Fuel Wasted on Level in Climbing Moderate Hills

That the motor of an automobile climbing a moderate grade uses no more gasoline than it burns when traveling on the level has been shown in tests recorded by Prof. Thomas R. Agg, of the Iowa State college. Experiments indicated that the engines do not work to capacity on the level, much unconsumed gas being blown out through the exhaust. Operating on medium-steep hills with grades up to seven per cent, he says, motors function with greater efficiency. In moderately hilly country there is hardly any increase in the cost of running automobile engines.



Scenery in the Cavern "Wonderland" and How the Explorers Had to Travel, Creeping along Low Passages and Scaling Heights in the Manner of Mountain Climbers

New Underground Wonderland Found in Virginia

Species of vegetable and animal life and rock formations, more spectacular than those already known in other parts of the caves are reported to have been found by a party of explorers in a chamber of the Endless Caverns, near Newmarket, Va. They lowered themselves down a steep passage with eighty feet of rope and entered what they describe as a sort of subterranean wonderland where intricate passages, frosted with stalactites glittering in the glare of the flashlights like icicles of rock, stretched away on all sides. To reach some of the small galleries and recesses, the adventurers had to lie flat and push themselves along with hands and knees. The caverns, geologists believe, mark the courses of underground rivers that worked their way through the strata and dried up many years ago.

High-Pressure Car-Washing Plant Fits Large or Small Garage

Suitable to installation in small as well as large garages, a high-pressure air and water system for washing automobiles has been devised. It can be used wherever water and electric current are available, is simple to operate, and cars can be washed inside and out and under the hood in from eight to fifteen minutes, it is said. After washing, remaining moisture is blown off with a blast of air, and the car wiped with chamois skin. The outfit consists of two high-pressure air and water tanks, a tank for distillate, compressor and motor, mixing chambers, "guns" and nozzles. The tanks are so arranged that while one is used, pressure in the other is being restored. The two working together in this manner, it is possible to use a five-horsepower compressor even for large jobs. Upholstery, rugs and curtains are cleaned by blasts of air, and the distillate mixture applied through special sprays, softens grease and road tar on exposed parts.

Through Long Hose and Nozzle, Spray from Pressure Tank Reaches All Parts of Car

Swimmers Garbed in Unsinkable Bathing Suits Which Are of Great Aid in Teaching Beginners

Bathing Suit Keeps Swimmer Afloat and Helps Beginners Learn

An unsinkable bathing costume which keeps the wearer afloat in water, aids in swimming and helps beginners to master the sport. Fashioned like an ordinary suit, the garment leaves the limbs entirely free for movement and needs no inflation. In use, it holds the swimmer in a horizontal position and, being light in weight, adds no extra burden to retard progress. It is said to be of great value in developing new strokes or practicing trick feats. The costume is easily put on and is adapted to lifeguards who often support one or more persons in the water at the same time.

Center Photo © Keystone

Left, "The Mocker," and Right, "President Wilson," Hero Pigeons of the United States Army Injured While Flying over German Lines with Important Messages; Center, Typical Racing Homer

Pigeon Messengers of Peace and War

Racing Homers Maintain Communications When Other Means Fail and Form Important Link in World's Army Tactics

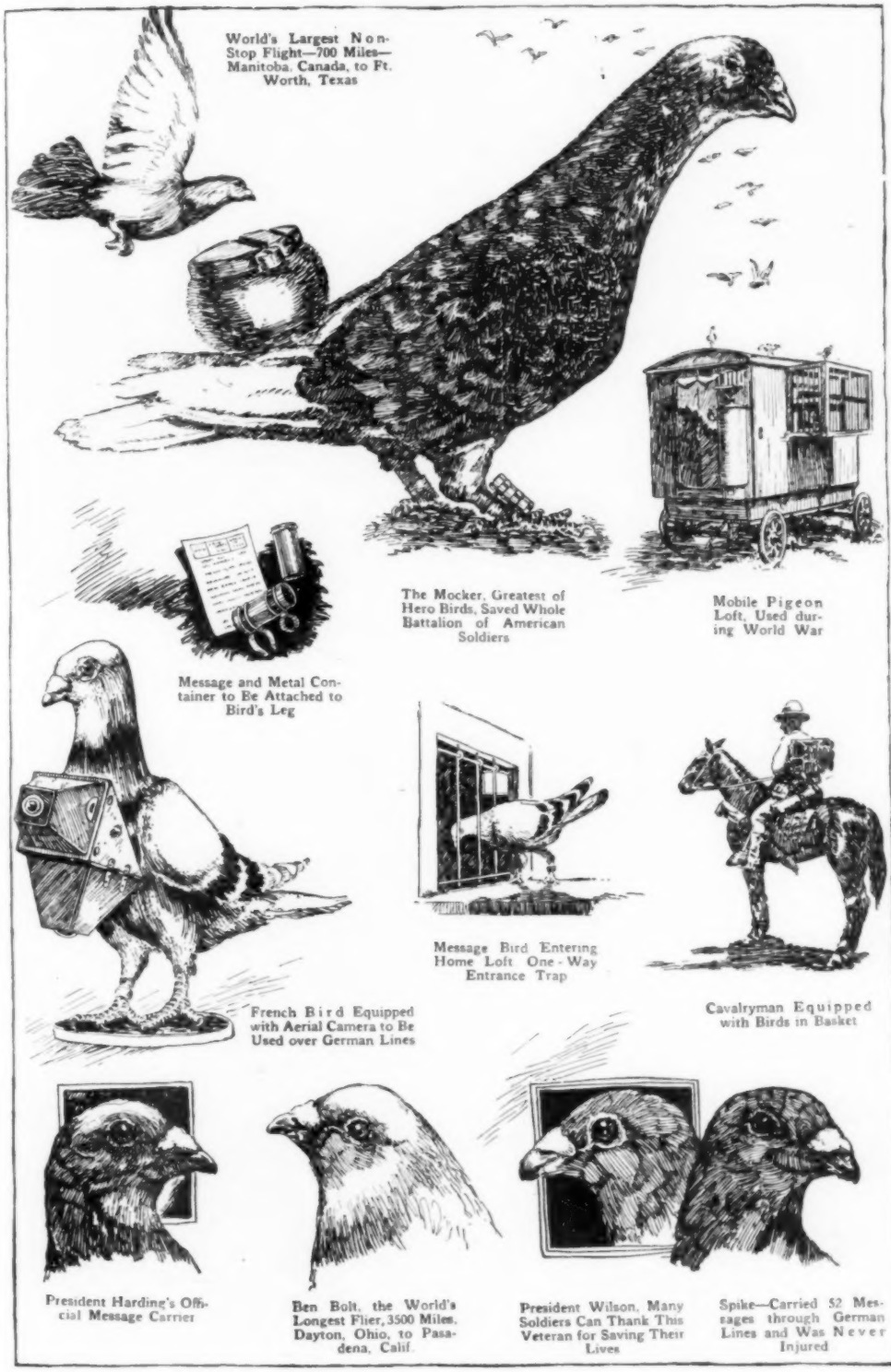
DESPITE the advances made in scientific methods of communications, homing pigeons, message bearers of the early Egyptians, are still relied on to maintain contact between widely separated places when all other means have failed. Whether the ability of these racing birds to return to their home lofts when released at distant points is due to instinct, intelligence or to some yet unknown power of sense direction has not been definitely established.

Many reasons have been offered, and it has even been suggested that a network of delicate electric forces might be responsible for the pigeons' faculty of finding their ways back home after being carried in masked cages to places hundreds of miles away.

Numbers of these birds are credited with achieving tremendous tasks and heroic services. A short time ago, a fishing party left a Panama port in a stanch vessel, but were not heard from for several days during which a terrific storm raged over that locality. Preparations were being made to institute search for the boat or evidence of its fate, when a homing pigeon that had been taken by one of the crew of the "lost" ship, appeared at the government station, dripping wet and nearly exhausted. It bore a message to the effect that all was well aboard the fishing vessel and gave the location of the craft.

While it is common for homing pigeons to cover courses of 200 or 300 miles, some can fly more than 1,000 miles without apparent harm. Such flights are generally made in a series of "hops," the birds taking to shelter at night and resuming their journeys with daylight. Heavy rainstorms have little effect on them, and many records of fast flying have been made by pigeons forced to go through steady downpours. Nature protects them, covering the wings with a natural powderlike substance which keeps the moisture from penetrating to the skin.

In order to teach the "squeaker," as the youngster is called, a trainer first drills it to "trap" properly. This consists in entering the loft through a swinging-gate arrangement which hangs on a pivoted shaft. Alighting on the landing board, the bird is coaxed by feed within to thrust itself against wire strands which rise upward as it passes and drop into place again to prevent the pigeon's exit. Backward birds are urged by the gentle use of a light whip. After they have learned to trap, they are taken from one to two miles from home and "tossed," or released, to



World's Largest Non-Stop Flight—700 Miles—Manitoba, Canada, to Ft. Worth, Texas

The Mocker, Greatest of Hero Birds, Saved Whole Battalion of American Soldiers

Mobile Pigeon Loft, Used during World War

Message and Metal Container to Be Attached to Bird's Leg

Message Bird Entering Home Loft One-Way Entrance Trap

Cavalryman Equipped with Birds in Basket

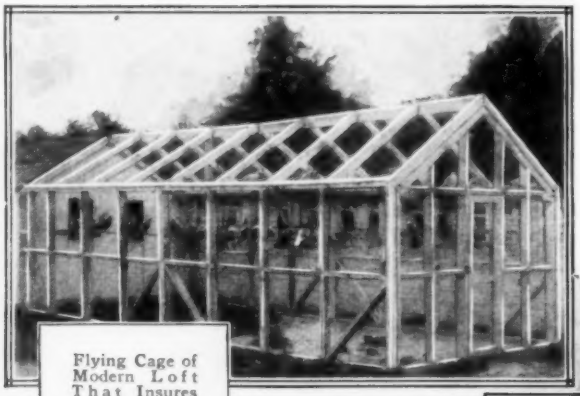
French Bird Equipped with Aerial Camera to Be Used over German Lines

President Harding's Official Message Carrier

Ben Bolt, the World's Longest Flier, 3500 Miles, Dayton, Ohio, to Pasadena, Calif.

President Wilson, Many Soldiers Can Thank This Veteran for Saving Their Lives

Spike—Carried 52 Messages through German Lines and Was Never Injured



Flying Cage of Modern Loft That Insures Healthy Stock

Setting Clocks to Time Arrival of Racing Pigeons at Home Loft

Placing Bands from Racers' Legs in Clock Safe for Contest Judges

fly back. The distance is gradually increased, the trainer purposely keeping the little students hungry to assure their return for food, since a carefully raised homer is not likely to forage for food, especially on short flights. As they progress, courses of 500 or 600 miles become a regular feat for the pigeons. While many records exist of birds flying 1,000 miles, some have gone much farther. And speeds of more than a mile a minute have been maintained by countless homers on ordinary test flights.

The pigeon division of the United States army was not in existence at the beginning of the war, while the French, German, Belgian and English armies had wonderfully developed branches of this service. The foreign armies had upward of 105,000 birds and 8,000 men each in this service. During the early part of their participation in the war the rapid advance of the Americans found the means of communica-

Sending Pigeon from Airship "Shenandoah" to President Coolidge

whole battalion. When a lone soldier went on reconnoitering duty through the enemy lines, he carried two birds in a small willow basket on his back. Within the basket the birds were placed in small canvas corselets and were suspended by rubber bands so that they would not be injured by the movements of the soldier in walking, falling or running.

Infantrymen were equipped with small silk bags filled with oxygen into which the birds were put when a gas attack came over the lines. At times, the pigeons were with the men in the trenches that were filled with mud and water, and had been without food for days; yet when released, so great was their vitality, they reached their destinations very inadequate. Because of the pounding of the heavy artillery, radio was ineffective and telephone service often impossible. It was then that the pigeon came into its own. "The Mocker," greatest of all hero birds, on the morning of Sept. 12, 1918, arrived at his loft from the Beaumont front with his right eye shot out and his head a welter of blood. He carried messages that gave the exact location of advancing enemy batteries. This information enabled the allied artillery to save a

Every Large City Has Its Flocks of Tame Pigeons That Roam the Streets Unclaimed

nations with but few exceptions. Ninety per cent of the messages in France that started out with the birds were delivered.

On the morning of Nov. 5, 1918, "President Wilson" arrived at his loft after a flight of twenty kilometers in twenty-one minutes, with the left leg shot off and hanging to his body by one of the tendons. He lost his leg, but delivered the message in jig time. A more lucky bird was "Spike." He delivered fifty-two messages through all kinds of shell fire and in the worst possible kind of flying weather, and was never injured.

About the year 1916 the French introduced the aerial camera. This little instrument weighed scarce two and one-half ounces and was principally made of aluminum. It was fastened to the breast of the bird with small straps and rubber bands. Each camera had two lenses, one pointing forward and the other downward. Inside was a small rubber ball pierced by a minute hole. This ball was pumped tight with air. After the bird was released, the air slowly leaked from the container and upon complete collapse released the shutter; thus taking the picture.

The bird circled to a height of 100 to 300 feet. It was too small to be hit with bullets and too high for the artillery and gas. The tiny films, when greatly enlarged, gave wonderful information. Often the enemy sent up falcons to kill the allied birds, but the French placed small bowllike whistles on the tails of the birds, and when the wind blew against them, a loud whistling noise issued forth to scare away the falcons. As a pastime and sport, the birds are being raised in practically every country in the world by sportsmen who enter them in contests of speed and endurance. Records are carefully kept of all such performances, and selective breeding has resulted in producing pigeons that can easily fly 500 miles with an average speed of a mile a minute. Probably the longest distance ever covered during a test by racing homers is a flight from Denver, Colo., to Fall River, Mass., in which two birds flew more than 1,800 miles and arrived at their home loft in good form.

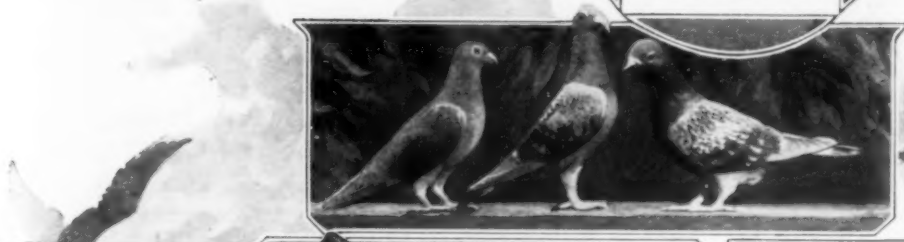
Not only are the birds of great value for military and racing purposes, but they have been entrusted with the exchange of news reports, private communications, and have even been sent with the craft taking part in yacht races to keep those at shore informed as to the progress of the run. Laws have been passed in many countries, making it a serious offense to kill a pigeon, in order to protect the homing variety which at any time may be carrying valuable data.

Like race horses, pigeons which prove of great ability to travel long distances swiftly, are used to stock the flying teams.

Messenger-Pigeon Carrier of Argentine Army Going Forward into Line for War Maneuvers

Prices paid for them often reach several hundred dollars. One loft of 150 racing homers, recently sold in England, is said to have brought $18,000. Private individuals by the thousand give time and effort to breeding and racing the birds. Societies exist in every state of the union for the purpose of promoting interest in the work, and national contests are annually held to encourage the development of the fleetest kinds. As a rule, the racing homer is so highly bred and schooled that it will refuse to occupy a coop which is not kept in the best condition. Their feed is of selected grains, aged for from one to two years before being given the birds. It is with the help of the pigeons' characteristic fondness for such feed as hemp seed and rice that trainers are able to teach them distance flying while they are still quite young.

Inserting Message Tube into Holder Tied to Bird's Leg



Long - Distance Racers of Strong Light Body and Powerful Wings

Leg Bands and Dispatch Holder Usually Employed in Military Services

Whistles Are Fixed to Tails of Homing Pigeons to Frighten Off Hawks Bent on Attacking the Flyer

While all pigeons at one time were more or less given to homing, most of them have been bred into show and fancy specimens. The racing homer is the result of careful crossbreeding which has produced a pigeon that has strength, intelligence, and a tall graceful form marked by a light body and powerful wings.

In the days when ancient Rome's legions marched forth to battle, carefully guarded pigeons accompanied them. If the passage of foot messengers was prevented by the enemy, the birds were released with messages to fly over the heads of the opposing armies. Rarely did an imperial prince of those times set out on a long journey without the imperial pigeon cote being included in the train of attendants and equipment.

Slot Machine for Sandwich and Pie Saves Luncheon Time and Cost

At luncheon periods in a western factory, workers find a slot machine that delivers a sandwich or a piece of pie for a

Self-Service at Handy Two-Compartment Slot Machine That Dispenses Sandwiches or Pie

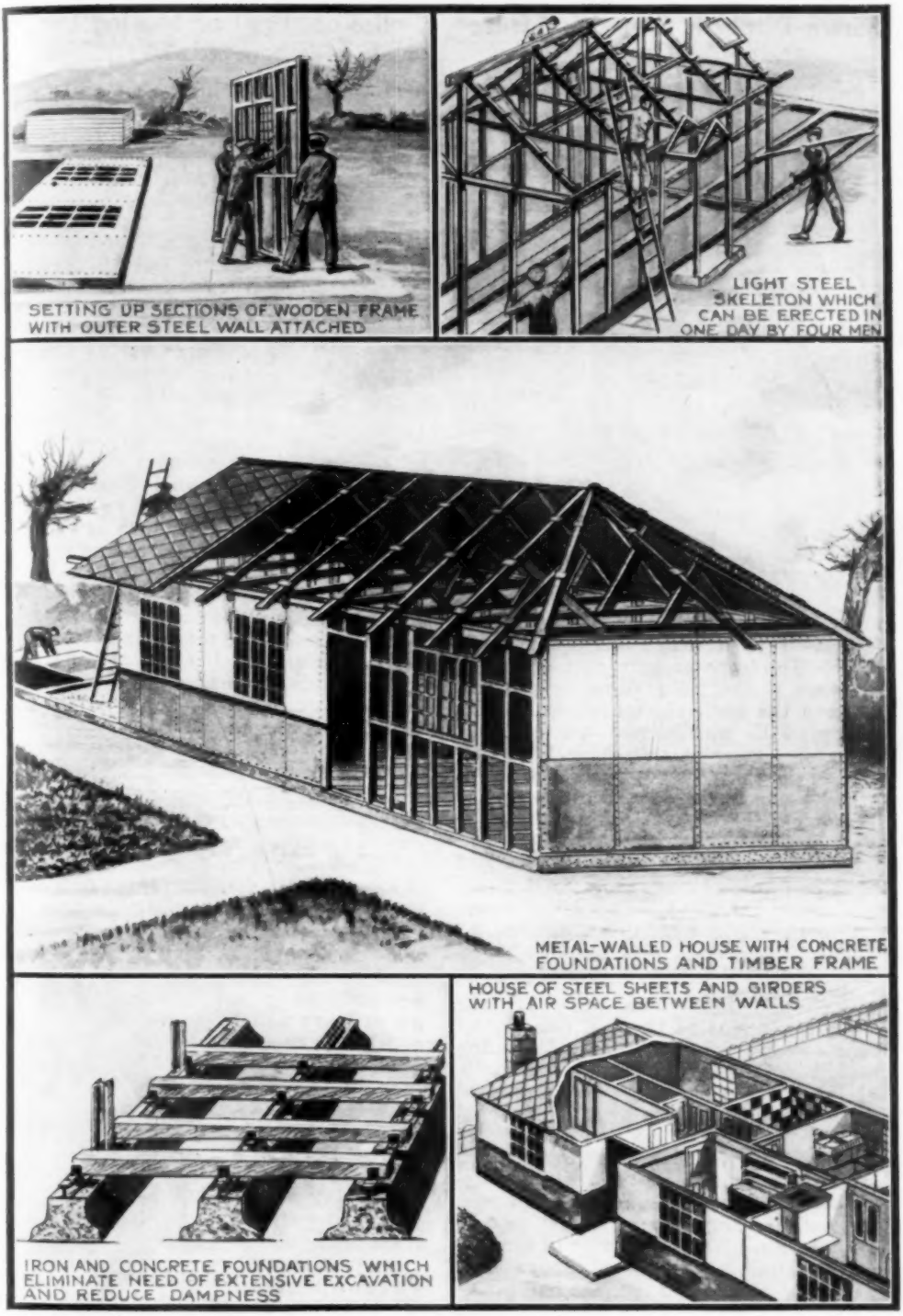
dime, a time and money saver when they do not care to purchase a more elaborate meal. The food is wrapped in stiff-paper packages and fresh supplies are put in each day. Pulling a button rod at the side of the machine releases the purchase and two kinds of sandwiches can be obtained from the same cabinet. The company owning the venders, is thus spared the expense of hiring salesmen for the refreshments.

Speeding Plane Hooks on Blimp Fifteen Hundred Feet in Air

For the first time in history an airplane flew up from the ground, hooked on to a speeding dirigible, and then cast loose and flew away during recent army aircraft maneuvers at Scott field, Ill. The small messenger plane used in the successful experiment remained attached to the "TO-3," a non-rigid dirigible, for ten minutes, then its motor was started again, the hook released and the airplane flew back to earth. A metal hook fastened over the engine of the plane and a trapeze hanging from the "TO-3" were the only equipment used. The airplane flew at eighty miles an hour, while the big gas bag was jogging along at fifty miles an hour. As the hook snapped into place, the airplane pilot shut off his engine and the plane hung in place. The new army semi-rigid airship "RS-1," now being assembled at Scott field, is being fitted with a similar device, so that it can carry a scoutplane, to be launched and recovered at will. The "RS-1" is the first American-built semi-rigid. It will be 282 feet long, seventy and one-half feet in diameter and have a gas capacity of 719,000 cubic feet of helium. Four 300-horsepower Liberty motors will drive it at a full speed of seventy miles an hour and a cruising speed of fifty-five miles. The navigating cabin, thirty-five feet long, will have sleeping quarters for officers and men, and a trap in the floor, to reach the scoutplane slung beneath.

Steel Houses Built in Single Day Reduce Cost of Construction

To furnish comfortable but inexpensive homes that can be erected in a short time, several types of dwellings built mainly of steel plates have been tested in England. The metal parts and framework are partially assembled at the factories, so that a few men can set the complete skeleton up in an ordinary working day. The frames of some of the structures are of timber, while others consist of light iron-work to which the sheets are attached. When completed, the walls of the houses are hollow, permitting an insulating air space which equalizes temperatures throughout the buildings and aids in keeping out both heat and cold. Inner and outer finishes can be readily placed over the metal, some of which is rust-proof, to prevent staining the covering materials. Some of the models require no exterior stone or cement coatings since the surfaces are decorated and colored in imitation of tile and other effects. Flues are constructed of concrete which in many cases also forms the foundation supports, thus eliminating elaborate preparation for bases. This method is said to prevent dampness and vermin, and reduce the hazards of fire. In the finished state, all the metal work in the houses is hidden, presenting an appearance much like ordinary modern dwellings. With the sections of the buildings ready for assembling on the site, three motor trucks are sufficient to transport the material for an entire structure. Though but a few days are required to erect and complete such homes, they are claimed to last for forty years with little need for repairs and small outlay for resurfacing due to weather.


SETTING UP SECTIONS OF WOODEN FRAME WITH OUTER STEEL WALL ATTACHED
LIGHT STEEL SKELETON WHICH CAN BE ERECTED IN ONE DAY BY FOUR MEN
METAL-WALLED HOUSE WITH CONCRETE FOUNDATIONS AND TIMBER FRAME
IRON AND CONCRETE FOUNDATIONS WHICH ELIMINATE NEED OF EXTENSIVE EXCAVATION AND REDUCE DAMPNESS
HOUSE OF STEEL SHEETS AND GIRDERS WITH AIR SPACE BETWEEN WALLS

Courtesy, The London Illustrated News © G. H. Davis

Developments of Steel Dwellings to Solve the Housing Problem Have Resulted in Several Types Consisting of Partially Assembled Sections That Reduce Erection Costs and Provide Cheap Homes

Green Elephant Carved in Hedge by Artist with Shears

Fashioned from the green foliage of garden bushes, the figure of a large elephant has been made by an artist to add decoration to a hedge surrounding his house. The leafy statuary, formed in lifelike pose, presents a realistic appearance. To keep the outlines smooth and sharp, new growths and shoots are carefully trimmed. Other animals have been imitated in the same way by the hedge sculptor, who selects subjects according to the grouping and size of the bushes. The elephant is constructed in the familiar attitude of a circus "jumbo" with extended trunk as though in search of food.

Lifelike Figure of an Elephant Carved in Thick Foliage of High Hedge by an Artist Who Uses Garden Shears to Do His Sculpturing

Leaks in Lake Stopped with Plugs to Check Water Waste

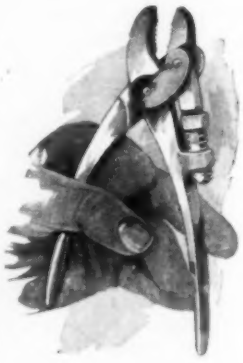
By plugging holes in the bed of Elk lake in the mountains of Oregon, the flow of large streams issuing from neighboring foothills was checked. During a drought, the springs feeding the lake diminished in volume allowing the level of the pool to fall low enough to expose outlets that were difficult to locate during normal stages. As rapidly as the openings appeared, they were filled with concrete. The outlets ranged from two to twenty feet in width. With the return of the season of rainfall, it was noticed that two rivers several miles from the lake had greatly decreased in depth, and distant springs were reduced to but a small part of their normal flow due, it is thought, to the plugging of the larger pool.

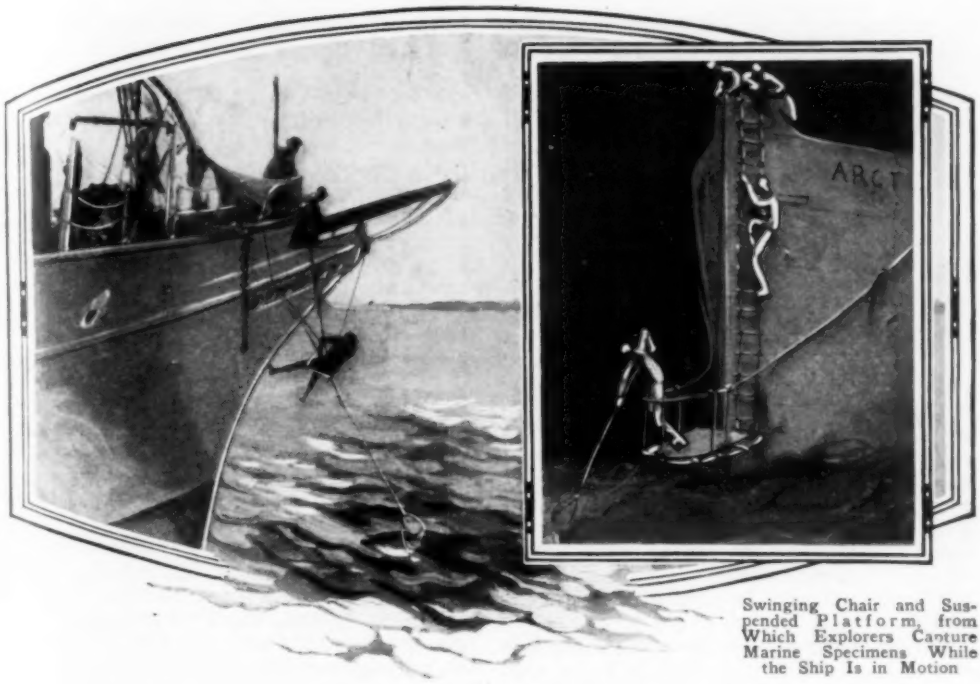
Police on Trail of Missing Persons Find Thousands Every Year

One of the busiest branches of the New York police department, is the bureau that handles reports of missing persons. Last year, of the 8,000 individuals for whom search was made on these reports, only twelve were unaccounted for, and of the 6,000 cases of "absentees"—those away from their homes for indefinite intervals and about whom lawyers and friends wished information—only forty-four remained unsolved. The department draws a distinction between cases that occur in the day's routine, such as those of lost children and the like, and those that have dropped out of sight. Inquiries came to the department from other communities to the total number of more than 3,000 and all but seventy-one were traced. That men are naturally more roving than women was shown by the fact that 1,800 girls under 18 years old were missing as compared with 3,300 boys, and 2,700 adult women against 4,553 adult men.

Pliers Combine Four Tools in One and Have Adjustable Jaws

As a handy implement for the tool chest, pliers designed with adjustable jaws can be used also as a screwdriver, wire cutter, and pipe or nut wrench. They can be made to grip any circular article up to one and one-eighth inch in diameter. A threaded attachment, convenient to the user's thumb, governs the setting of the jaws and permits them to be quickly changed to meet various needs. The device is small enough to be carried in the pocket or stuck in a belt and avoids loss of time often taken up in searching for tools.





Swinging Chair and Suspended Platform, from Which Explorers Capture Marine Specimens While the Ship Is in Motion

Explorers to Solve Deep-Sea Mysteries

Floating Laboratory to Invade Remote Stretches of Oceans in Search for Specimens of Unknown Marine Life

EQUIPPED for a cruise of 13,000 miles through little-known ocean wastes, the ship "Arcturus," fitted out by scientists of the New York Zoological society for the study of marine life will invade remote parts of the Sargasso sea.

The vessel will include in its furnishings several large aquarium tanks in which specimens of fish and other denizens of the deep can be kept alive for study and examination during the voyage. Dark rooms have been built aboard for the purpose of photographing and spectroscopic investigation of those forms of life taken from great depths. Many of these emit a glow similar to that of the firefly, caused by phosphorescent materials in their bodies. The mysterious sea of floating weeds and drift will be studied with a view to solving some of the questions which have puzzled mariners since the days of Columbus' first voyage, when his fleet of small vessels wandered for two weeks in the patches of vegetation.

As the chief object of the expedition is to devote attention to the study of the fishes and other organisms that live on and near the surface of the waters and those existing several hundred fathoms down, various arrangements have been provided for securing the required specimens. But all of them will be kept in the aquariums under conditions as near like their native waters as is possible. A number of devices for deep-sea dredging have been installed on the ship and diving apparatus will be ready for use for work in shallow waters near shores.

Special appliances are to be employed for the collection of marine life inhabiting the surface. One of these is a raft-like platform attached to the side of the ship's hull and from which the explorers can gather their quarry while the craft is in motion. Another arrangement will permit a collector to dangle from the side of the vessel, and armed with a long pole and net dip up any specimens within his reach, without slackening the speed of the ship.

Motion-picture machines will be kept busy recording the activities of the party

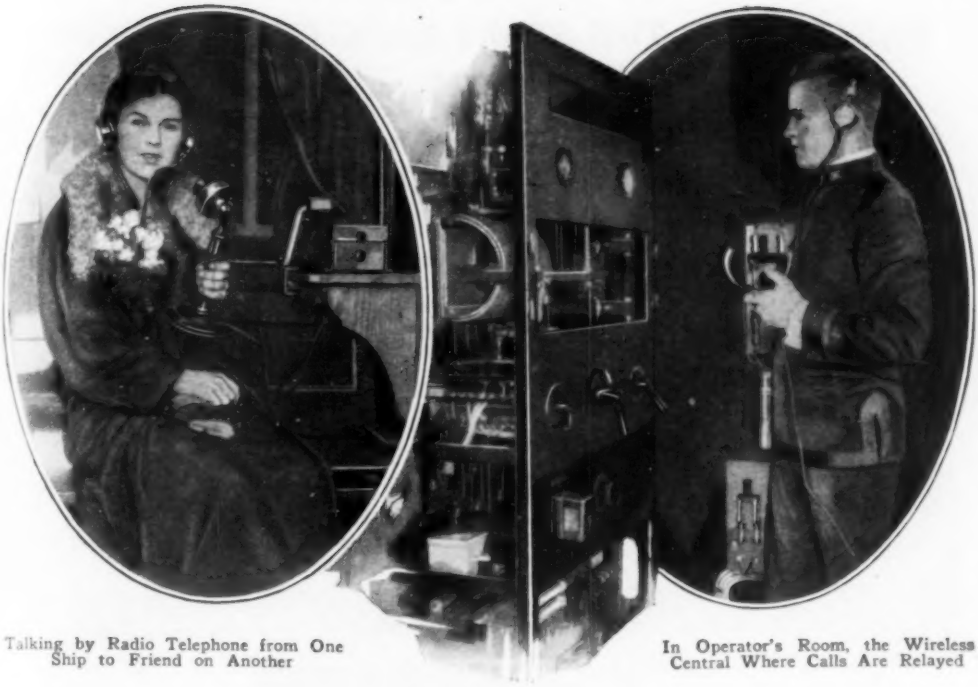
as well as registering the movements of the interesting fish and animals met with in the search. Ordinary cameras with powerful lenses will be used for still photographs and a complete wireless outfit with which the explorers will be provided will enable them to send reports describing the progress of their work to any point equipped to receive the messages. Thus, more than one log of the journey can be kept up in case accident should befall the expedition.

Although most of the scientists' time will be taken up by work at sea, short trips will be made into western Africa in search of live birds and reptiles for the collections of large museums and zoological gardens. To combat the dangers from savage peoples and wild animals during these incursions, each man will be heavily armed. Medical supplies will also accompany the party as a remedy against the hazards of fevers and jungle sicknesses which often make life unbearable for the hardiest explorers in that section of the world.

Previous expeditions on similar errands traversing neighboring territory to that planned for invasion by the sea hunters, have added many rare specimens of water and land animals to the collections of the scientific institutions. It is believed that the Sargasso sea alone will reveal many unheard of creatures living in the tangled masses of floating vegetation. This region, which has been described as lying within an area extending from the Gulf of Mexico to Morocco, is dotted with expansive patches of dead seaweed which constantly change position as they are swept about by the ocean currents.

The vessel from which the activities will be carried on is said to be one of the largest ever used for scientific purposes or deep-sea explorations of this nature. It is 280 feet long. When not actually employed in the quest for living subjects for study, the various members of the group will devote their efforts to examining and classifying those already captured, thus saving considerable work at the end of the trip. Comparisons can be made with specimens heretofore recorded, and any that duplicate those known to the scholars might be discarded to again roam the hidden tracts of the sea which once inspired weird tales of derelict ships enmeshed in the mysterious ocean jungle.

Studying Wild Seals at Close Range Where the Animals Have Not Been Harried by Hunters and Remain Unafraid of People Approaching Them with Harmless Intentions



Talking by Radio Telephone from One Ship to Friend on Another

In Operator's Room, the Wireless Central Where Calls Are Relayed

Sea Passengers Telephone by Radio to Persons on Other Ships

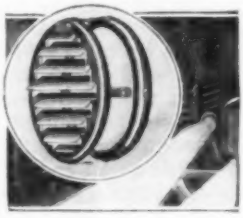
Conversation between passengers on different ships while at sea has been made possible with a system of radio telephones that one company has installed on its liners plying between San Francisco and Honolulu. Distances of 500 miles during the day and 1,000 miles at night are covered with little difficulty, it is said. The voice is broadcast through apparatus similar to that of a usual sending station and is picked up on telephones with special tuning apparatus, the talkers wearing regular headphones.

Keeping the Zoo Full

One of the chief items in the upkeep costs of large zoos is the expense of new animals to replace those that die. Proper food and expert care keep the mortality rates within bounds, but monthly purchases for new specimens sometimes amount to hundreds of dollars, and remote parts of the earth are continually being scoured for captives, that empty cages may not greet the visitors. The highest death rate occurs among the birds, next come the mammals with the greatest financial loss. Reptile casualties are the lowest. In a single month at the Bronx zoo, twelve mammals died, including a bonnet macaque and a white-faced sapajou, rare kinds of monkeys. A crocodile, two tortoises, fifty-two birds and three snakes died in the same period. Monthly expenditures for new specimens range from twenty-five cents for a box tortoise to $900 for a pair of baboons.

Shade Snapped on Auto Headlights Stops Glare and Focuses Rays

Glare from small-car headlights equipped with plain glass lenses can be stopped easily and the rays directed upon the road, with a metal cover for the lamp slipped over the rim and held by four tabs that fit about the rivets in the edge. The shield is slotted with a number of apertures, each shaded by a strip reaching across the face of the disk and set at such an angle that the glow of the light is projected downward instead of streaming straight ahead where it is likely to confuse approaching drivers. The attachment costs less than special lenses and can be removed or put in place in little time.



THEATER OF THE STARS TEACHES ASTRONOMY

Inside the Dome with Its Starry Sky, and Close View of the Projecting Instrument

Nearing completion at the German museum in Munich, is a theater where the heavens and the starry wonders they contain have been reproduced in miniature as an aid to the study of astronomy. It is built in the form of a large dome and across its interior, the movements of 4,500 stars —all that are visible to the unaided eye —the sun, moon and the planets are traced by means of spots of light projected from a telescope arrangement occupying the center of the stage. On the spherical top of this instrument are thirty-one lenses placed like the facets in a fly's eye. They project the little light points from a 200-candlepower lamp on the inside. In addition to these lenses are eleven projectors for marking in dimmer light the misty path of the Milky Way and the planet lights are contained in a cylindrical "tail" at one side of the telescope. The entire apparatus is moved by a small electric motor regulated so that the courses and movements of the heavenly bodies are exactly reproduced. Phases of the moon are shown by means of shades. The names of the constellations and of individual stars flame out in letters of red and white lights at the will of the lecturer or automatically if desired. Summer and winter skies can be represented by adjusting the apparatus and there is a clockwork mechanism to show the year, date and hour. When the spectator enters, he sees the dome lighted to give the appearance of a night sky with its pulsing stars. As the "sun" comes up, colors change and the realistic silhouette of the city of Jena, where the apparatus was designed and constructed, is revealed to increase the illusion. Five years were required to build the apparatus. A considerable number of persons may be accommodated at once inside the theater. With an unobstructed view of the dome they can study regardless of the weather.

Railway's War on Mosquitos Costs Nearly a Million Dollars

In the past few years, a western railroad has spent almost $700,000, not counting screens and the work of physicians, to fight mosquitos along its lines. Not long ago, in a section of Arkansas, the pests became so numerous that they seriously interfered with train service by spreading malaria among workers and train crews, thus making them unfit for work. One hospital, ten years ago, treated 350 cases of mosquito-contracted malaria, and in a hamlet of 300 persons, everyone was suffering from chills and fever. The railway here cuts through lowlands where stagnant pools and similar breeding places for the insects abound. The campaign involved ditching and draining this section, treating the waters with oil and keeping squads of men constantly searching for other places favorable to breeding.

Front Light Tells if Stop Lamp Is Lit to Prevent Auto Accidents

Attached to the rear of the motor thermometer on the front of a car, a handy light signal has been devised which automatically tells if the stop lamp is working, thus decreasing the risk of rear-end collisions. At the same time the attachment illuminates the thermometer. It also has red and green "courtesy" lights at the side and a front "slow" warning in red letters, to tell approaching drivers that a turn or stop is contemplated. The principle of this lamp is applied in a similar one for the ordinary radiator cap and in a small dash light for the instrument board. They are

Front Light with Side Signals as Seen by Approaching Motorist and from Driver's Seat

easily installed, only simple wiring being necessary, and eliminate uncertainty as to the behavior of the stop signal.

Handrail Attached to Stepladder Is Aid to Safety First

Easily attached to any stepladder, a strong handrail, devised by a British inventor, is designed to aid in keeping the

Keeping Balance on High Ladder Is Easy with Handrail Securely Fixed in Sockets

balance and makes it safe to use the top steps, thereby getting greater service from the ladder without extra risk. The rail is simply a stout wooden bar, inserted in a holder on the side and placed through a hole in the top board.

Church Echoes Stilled by Sawdust in Plaster Instead of Sand

By mixing the plaster with sawdust instead of sand, a contractor is reported to have successfully overcome the acoustic problems of a large church auditorium in California. The walls seemed to absorb the sounds instead of reflecting them, as frequently occurs where hard surfaces are used, and noise from the street was also excluded. Corridors, arches and pillars with many curves, had made the interior unusually subject to echoes, but the sawdust apparently silenced them. The builder is said to have adopted the idea from his recollection of a home in the middle west, where the workmen, unable to obtain sand, used sawdust instead.

Golf Putter and Stymie Jumper Fits Right or Left Hand

A combined golf putter and stymie "jumper," which can be used for either

Lofting a Golf Ball over Another with Stymie Side of Putter; Insert, the Adjustable Head

the right or the left hand, has an adjustable head so that it can be made to fit the stroke of almost any player. Near the edge of the green, the stymie can also be employed to pitch the ball toward the cup. Because of the center balance of the haft on the head, the club cannot curve out of line with the ball and hole, it is said, when the player swings back for the putting stroke. Since the implement can be readily adjusted to fit the grip of almost any player, several persons may make use of one club in the same game.

How Weather Affects the Health Shown by Tests at Zoo

Studies of the influence of the weather on men and animals were made not long ago in a series of tests at the zoological gardens in London. As a result of the experiments, it was announced that dry cold is a stimulant, but wet cold profoundly depressing to the system and is really "bad" weather, although there may be many other times when it is unpleasant. "Rawness" is injurious because it causes a rapid loss of heat from the skin, resulting in chills. To prevent this, the layer of air next to the body should be retained by means of clothing that can be buttoned at the neck to keep the warm air which rises, from escaping. Gloves with gauntlets and coats with sleeves that fasten tightly about the wrists, serve the same purpose. A sheet of cotton wool wound about the chest has been found an excellent air trap, and two light overcoats are preferable to a heavy one if the latter makes the wearer sweat.

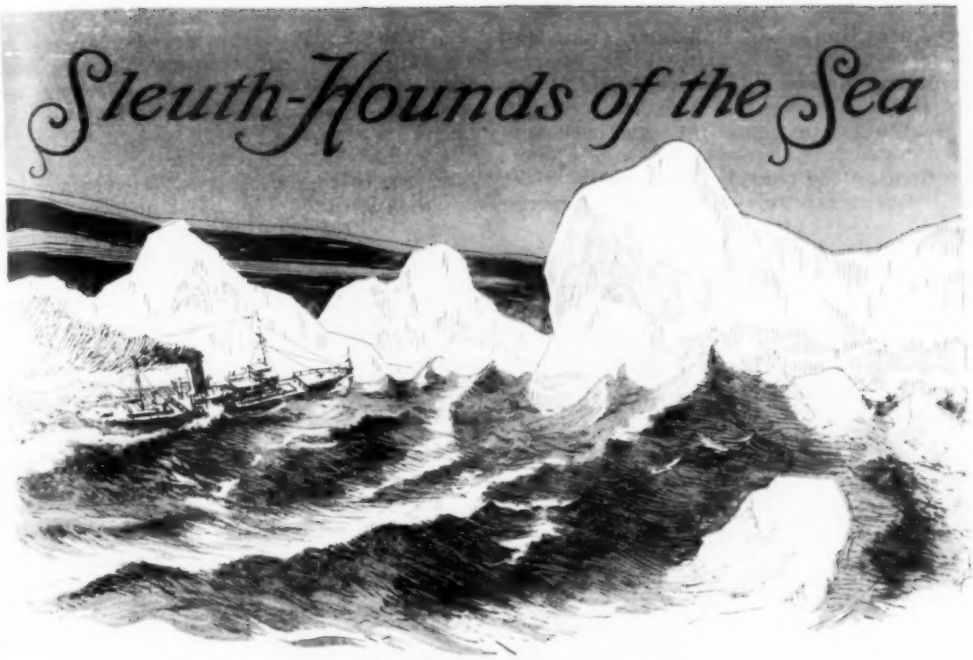
Glass Side Curtains for Open Cars Quickly Changed without Tools

Bound in steel strips and inclosed in panels of the same kind of material as the car top, easily adjusted side curtains with glass instead of celluloid have been placed on the market by a western firm. They fit into slotted openings in the side bands, are said not to rattle, and as extra bars and props are eliminated, they open as a unit with the doors. Because of the narrow space between the glasses, the view from the inside of the car is less obstructed than with present styles of inclosures. Each pane is suspended within an inner frame which rests upon the car at only three points, thus decreasing the amount of vibration and guarding against breakage. No tools are needed to put the curtains in place, and when they are not in

Looking into Car with Glass Curtains, and Closer View of Door Panel with Fabric Border

use, they are stored in a handy carrier attached behind the front seat.

Sleuth-Hounds of the Sea



BY HAROLD T. WILKINS

THE tropic sun blazes down on the sparkling waters of a far-eastern sea where there is placidly steaming a remarkable vessel whose deck is crammed with buoys and ropes and studded with wonder-working instruments for tearing from old Oceanus the secrets hidden in his bed of slime.

Suddenly a hail comes from the bow to the wheelhouse, and the ship wakes into life, her decks humming with activity. The mirrorlike calm of the sea is slowly breaking before a long, heavy swell traveling from the horizon. A radio message flashes from the ship to a shore station, and in fifty harbors, for a hundred miles around, all work ceases. Vessels riding at anchor at once get up steam to strengthen their moorings; others, too far away to run for port, first heave to for safety, then ascertain in what quadrant of the whirling circle of disturbance they are, and steam swiftly before the storm. The dreaded typhoon is approaching, heralded by the radio message from a United States survey ship on duty in Philippine waters to take observations that may help to predict its path.

But this is only one of her many fascinating activities. The safety of every ship sailing the seas depends upon the accuracy of the charts, the careful soundings of dangerous waters made by her officers. Twenty or more of them and various launch and shore parties map out the 300,000 miles of shore line and waters adjacent to United States territories. Life on board is strenuous and exciting. The brain of the vessel is the chart room where expert hydrographers and land and marine surveyors daily record soundings of the sea bed taken by various instruments, including a steam winch on the after deck, a graded fathom line read by the leadsmen, and electric machines for sounding depths of hundred fathoms or less.

If the reader glances at a marine chart, he will see that hydrographical surveys are built up on a framework of triangles whose corners are the main points of the chart. Detailed marine surveys, showing the topography of adjacent coasts, are always urgently needed for the great trade routes on the seaways leading to busy ports and harbors. On a coast survey, the charting steamer finds out her position by running out to sea, picking out three fixed objects on shore for signals, and plotting the position with the aid of what are called "two-section angle instruments." But in narrow waters and shoaling channels, or in coral seas where the ship's bottom would be ripped out by one false move, the ship must use the even more accurate three-arm protractor.

This instrument is a graduated circle with one fixed and two movable radial arms. To plot the ship's position, the of-

ficer uses the fixed arm as zero point, and observes the two angles, set by the instrument, between three selected objects on shore or sea. The protractor is then moved over the chart until its three beveled edges pass through the three objects (shown on the chart). The center of the instrument now marks on the chart the ship's position.

Ten miles out from land, the shore signals cannot be seen, and then the ship steams past survey buoys anchored three miles apart and parallel with the shore line. Fixing her position with reference to these buoys, the ship can continue her work six miles beyond the limit of visibility of shore signals. While she is slowly steaming in a straight line, soundings are being taken, and officers mark on a chart a series of parallel lines, a quarter of a mile apart, and showing depths of ten to fifteen fathoms. Beyond these, deep-sea sounding instruments are used to obtain depths up to one hundred fathoms. The United States survey ship has on board the Sigsbee deep-sea sounding machine in which is used a weight, a cup for obtaining specimens from the sea bed and a thermometer. As soon as the eighty-pound weight strikes bottom, it is automatically released, and the specimen cup and thermometer shoot to the surface. Made to stand enormous pressures, the submarine thermometer is inclosed in a metal jacket attached to a rotating vane. When the bottom is reached, the vane whirls rapidly round, upsets the thermometer and breaks the column of mercury. As it shoots to the surface, reaching water of higher temperature, the expanding mercury overflows into a reservoir. The bottom temperature is found by reading off the length of the mercury column left in the thermometer tube. The work of mapping coast lines and taking soundings in the near-by waters is divided among expert surveyors who first find a baseline, and then fix, by means of angles, a series of positions far apart, from and to which other angles are measured to fix other stations. These are the main stations or corners of the "triangulation," as it is called. The baseline is obtained in several ways. Two shore stations, visible from each other, are chosen, with the ship midway between them. At a given signal, a flag is masthead-ed and dipped from the ship's truck, and observations of the ship's position are simultaneously made by the shore stations. Another way is to fire guns alternately from both ends of the baseline on shore when the ship dips her flag. Observers record the distance by counting the intervals of seconds between flash and report. Vigilant lightkeepers flashing sun signals across the 100 to 150 miles often separating observation stations are a striking feature of the work. They have to keep their lights directed toward the observers, for which purpose they carry heliotropes—mirrors reflecting the sun in any direction—by day, and electric and acetylene lamps by night. High above trees and houses soar lofty towers to give the observer a clear view many miles across country.

Radio and Depth-Finder Equipment of the U. S. S. "Hannibal," Used in Sounding the Ocean

On foreign shores, the nautical surveyor builds stone cairns on cliffs and headlands, sets up a tripod of stakes as a mark, or whitewashes spots on capes. He may also tie canvas to the boughs of trees for the same purpose in the bush or mangrove swamps of equatorial coast lines. Many miles of waters off flat shores are sounded by boats' crews who use as a marker a flagstaff flying neutral emblems. Flags of national significance when flown by survey ships engaged on this duty have been known to cause trouble.

Storms and an Error in Navigation Wrecked and Beached This Trawler, a Fate That Not Infrequently Visits Ships When Duty Calls to Perilous Waters

Meanwhile, a shore party is landed for the purpose of making a topographic survey. The surveyors ashore have to walk over every inch of land, and use a boat only to round cliffs and headlands or make stations from which to "shoot up" the ship or coast by their instruments. One of the shore party has to wade through swamps and find out, by questioning the natives, if the marshes in the rainy season break their bounds and to what extent. In savage lands, too thick with bush and jungle to walk over, the country is sketched from the ship, stations being made on board and sketches drawn at each station. Angles are then measured from the ship to hill spurs, peaks and ravines, while the officer who has to map the coast line, sketches river entrances.

Soundings and surveys of currents and tides are a very difficult part of the ship's work. A nautical surveyor must have a keen eye to read the signs of danger on the face of waters. A ripple on the surface of a tideway in calm weather is a warning of the presence of a dangerous submerged rock upstream quite close to the nucleus of the ripple. Birds hovering over the water, fish suddenly springing into the air, or discolored patches of sea, tell the mariner of neighboring shoals on which his ship may be driven. In the brilliant sunshine of tropical seas, where coral reefs abound, the ship must constantly test channels alleged to be safe for deep-draft ships; for, though under-water coral shines in strong light, a steamer may pass, within a mile and with only three fathoms of water under her keel, without detecting the coral from her masthead.

A "submarine sentry" towed at forty fathoms' depth may save many hours of hunting by revealing unsuspected banks and shoals. The submarine sentry is merely a sinker attached to a stout wire. If it strikes the bottom, owing to the water becoming shallower, it at once frees itself and rises to the surface, sounding an alarm on board the ship.

The wire drag is used in searching for submerged ledges and pinnacle rocks in dangerous waters. The drag is suspended horizontally, to any desired depth, by vertical wires leading up to buoys on the surface. It may vary in length considerably and is towed through the sea by launches which sweep an area of water at the depth to which the drag is set. If a rock, sandbar or wreck hits the drag as it is towed along, a horizontal wire catches the obstruction and a buoy bobs up from the water to show the danger zone.

Day and night, along the great transatlantic steamship lanes, coast-guard cutters keep watch for icebergs and icefields drifted southward by the Labrador cur-

rent in April, May and June. They send out daily radio warnings of the whereabouts and limits of the dreaded floes. At night, their three anti-collision lights of green and white, gleaming from the masthead, signal "all's well" to the navigator on the bridge of the liner passing westward along the fairway to Sandy Hook lighthouse.

Every survey ship is now equipped with the sonic depth finder of Dr. Harvey C. Hayes. A few months ago, a cable ship steamed into New York harbor with a thousand miles of cable on board. She reported that, with the help of two destroyers, who made surveys, she laid a cable over a submarine mountain 4,500 feet high in ocean bottom whose every hollow had been sounded by this depth finder. This had been done at a greatly reduced cost, by halving the amount of slack or loose cable payed out to lessen tension. The sonic depth finder is built to stand rough usage. Its sounder emits an electrically regulated sound which penetrates the ocean and the operator regulates the time between each impulse and its successor so as to accord exactly with the time of the returning echo. The human ear can detect a time difference of a very minute fraction of a second, and the depth finder has a possible error of only four feet in a mile of water. Research is being made to perfect a practical automatic recorder for this instrument, but, at present, any discrepancy in time between the repeated sound and the returning echo is corrected by re-echoing the original sound, which enlarges the time gap and finds and corrects the error.

Some other wonderful devices operated by the hydrographic survey include a portable automatic tide gauge, only ten inches square, but equal to larger instruments in speed and accuracy; an automatic current meter which, for two weeks without attention, makes half-hourly photographic records of ocean currents at a depth of 400 meters or less; and the Wenner apparatus used on board the ice-patrol cutter "Tampa" for finding the salinity of sea water by measuring its electrical conductivity.

It will be a surprise to the landsman to hear that scientists today hold the opinion that currents are caused not by the wind so much as by differences in weight, temperature and salinity of ocean waters. The bureau of standards has perfected an electrical instrument which measures saltness to the fourth decimal place, as the meter is dragged through the water in the ship's wake. Another proposed instrument, a thermometer, will automatically record depth and temperature on a chart.

Looking Down from an Airplane on One of the Trim and Sturdy Survey Ships the Navy Employs, a Service Requiring Special Equipment for Long and Hazardous Voyages

Four Million Dollars from Waste of One Chain of Plants

The value of careful reclamation of factory waste is shown by the annual report of the Ford motor-car company, giving sales of by-products from waste as $4,000,000 in 1924. All told, the company increased its sales by $13,000,000 by recovering waste and marketing by-products from all its activities. The coke plant turned out $1,500,000 in gas, benzol and ammonium sulphate. The slag from the blast furnaces was transformed into cement at the rate of 1,000 barrels a day. The body-parts plant returned $2,500,000 from the reclamation of wood waste, which was converted into crude charcoal, pitch, creosote, ethyl acetate, refined wood alcohol, methyl acetone and acetate of lime. The $2,500,000 worth of these products sold was in addition to quantities used by the company in its own work. All grades of plate glass made in the glass factory, and too small or otherwise not suited for car work, were sold to mirror companies and various other concerns. A 1,200-acre experimental farm adjoining the wheel factory sold large quantities of farm products and live stock, while surplus electric power from various generating plants added to the by-product total.

Fire Helmet Held by Guard Band Which Protects Face and Neck

To prevent firemen's helmets from being blown or shaken off, a safety band of leather and cloth has been designed for attachment to the inside of the headpiece and can be adjusted by a drawstring. An apronlike extension of heavy material, which can be removed in hot weather, is provided for protection of the face and neck against cold, water and sparks. The hood is said to make the helmet more comfortable to the wearer by covering its hard rough surface with a soft padding where the rim grips the head. Made of insulating material, the band serves as a safeguard when the fire fighter is working among loose electric wires.

Mirror on One-Man Street Car Helps in Handling Passengers

Street cars with one-man crews are being used in London and to assist the driver-conductor in collecting fares and opening the doors, a wide mirror has been placed at the front of the car so that the operator may keep an eye on the passengers without turning around. A ticket punch operated by the foot and an automatic change maker are other appliances which help the motorman. Doors and brakes have been fitted with safety devices to prevent accidents.

Front of One-Man Street Car with Mirror above the Motorman's Head

Waxer and Polisher Shines Floors without Changing Cloths

Time and labor in waxing and polishing floors and linoleum are saved with a two-sided moplike tool for the housewife. It has a V-shaped base with flat surfaces covered with cheesecloth. Wax is applied on one side beneath the fabric, which can be lifted off by releasing a spring, and the floor given a thorough treatment with that face of the pad. To polish, the other side of the mop is turned against the wood. The instrument is shaped to reach into corners and will last indefinitely.

Three-Fingered Knives as They Are Attached at the Rear of the Plowshares

Knives Placed at Rear of Plowshare Pulverize and Smooth the Soil

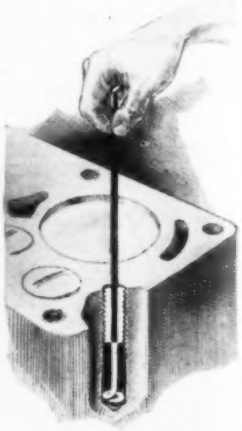
Easily attached to any plow, horse-drawn or tractor, a set of knives has been patented to pulverize the soil as it is broken, eliminating the air pockets that usually form and dry out the ground. Equipped with these blades, the plow practically performs the service of a harrow in addition to its regular function and as the knives move with the share and swing back to allow stones or other obstructions to fall out, they require no attention while plowing. They are curved and reach down to almost the full depth of the furrow and do not interfere with turning under stalks and other litter. They weigh but sixteen pounds to a set of three.

Fruits Coated with Raw Rubber Kept Fresh for Weeks

The most delicate of tropical fruits can be kept fresh and made to retain their flavor and any stage of ripeness by a thin film of raw rubber applied by a method claimed by Dr. P. J. S. Cramer in a discussion before the Pan-Pacific Fruit conference in Hawaii. When dipped into rubber latex, the scientist said, the fruit will become coated with an air-proof covering permitting shipment of the product as ordinary freight over considerable distances. Even after several weeks, he stated, such articles as strawberries, mangoes, and those so tender they cannot be exported at present from their native lands, remain wholesome and tasty within the latex film. In an experiment, the speaker said, green bananas were coated with the liquid for only half their length with the result that the unprotected portion matured leaving the incased part still unripe. The latex can be easily peeled off and the fruit requires no special cold-storage preparation.

Hand Cleaner for Engine Bolt Holes Eliminates Carbon and Breakage

Operated like a post-hole auger for drilling out the dirt for posts, a hand cleaner for removing carbon from auto engine-head bolt holes has been invented by a Nebraska man. A few turns of the wrist are sufficient to force the tool through the deposit and extract it, thus enabling the mechanic to fit the screw back into place with little difficulty. The process takes only a fraction of the time required to clean the holes with drills, blowpipes and compressed air.



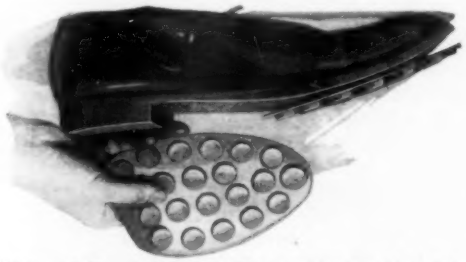
Deep-Sea-Going Log "Submarines" Cut the Cost of Homes

In the wake of puffing tugs, several monster rafts of logs glide out of the mouth of the Columbia river every year and are hauled down the coast to the lumber mills at San Diego, Calif. Tied with 150 tons of one-and-five-eighths-inch anchor chains, each is 900 feet long, sixty feet wide and thirty-eight feet at the center. As they strike the water from the "cradle" in which the logs have been

bound together, they sink deep until only twelve feet of the center part is visible above the water line. Like submarines skimming the surface with only a portion of the hull exposed, the rafts ride smoothly along with rarely a mishap as the logs have been dovetailed with great care so that no two sets of ends come together, giving the chains solid surfaces upon which to play and bind. For eighteen years these rafts have been hauled down the coast, this form of mass shipping having proved a success because of its saving in freight over other ways of transportation. One raft contains about 5,000,000 board feet of lumber, enough to build 300 houses costing about $7,500 each. It would take 1,200 cars to haul that amount of lumber by rail and the cost for the journey would be about $15 per thousand feet. Lumber schooners would charge nearly $6 per thousand, while the raft method costs less than $3, and besides, bark and waste materials sold at the destination, are said to return more than the towing charges.

Lightweight Rubber Sole with Studs Is Durable and Prevents Slipping

Rubber shoe soles, each with twenty-one protruding studs to afford the wearer a secure footing on slippery surfaces, are being manufactured in England. They are said to be light in weight and durable, and



Edge and Front Views of Thin Rubber-Studded Sole Compared with One of Leather

can be easily attached over the ordinary leather sole. Because of their thinness, they are not conspicuous.

Dustless Vacuum Street Sweeper Cleans without Water

Safeguarding public health by arresting the spread of dust during street-cleaning operations, an automobile sweeper

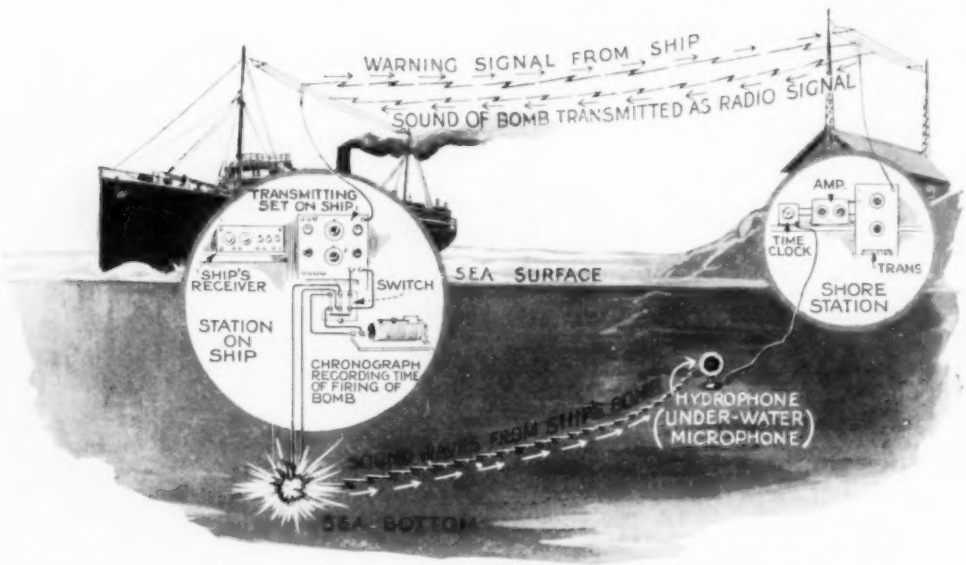
Dustless Street Cleaner in a Crowded Business District Where It Can Operate without Annoyance to Pedestrians or Vehicle Traffic

equipped with a vacuum arrangement, requires no sprinkling or flushing of roadways to aid its work. Resembling a large delivery truck, the machine is said to pick up anything from a pin to a barrel stave, and as it works without interfering with traffic or scattering particles of dirt among pedestrians, may be manipulated in the daytime on crowded thoroughfares. For residential neighborhoods, its noiseless movements adapt it for night operation. Though firmly lodged bits of dirt are easily removed by the sweeper, its constant use is said to be harmless to any kind of paving material. All litter gathered by the cleaner is collected in a large reservoir in the body of the truck, which can be quickly emptied when filled.

Phone Service from Moving Trains to Aid Travelers on Trips

Passengers on German railroads will be able to order hotel rooms and transact other business by telephone from moving trains, if apparatus constructed in that country fulfills expectations. Technical difficulties are said to have been overcome, and the phones are to be installed on lines from Berlin to Hamburg, Frankfort and Munich. If they prove popular, further distribution is contemplated.

RADIO REPORT OF SEA-BOMB BLAST TO GUIDE SHIPS



Photodiagram of the Combination Wireless and Under-Water Sound-Wave Device Developed for Use as a Direction Finder for Ships Navigating near Shore

The sound of the explosion of a small TNT bomb, towed along the side of a ship at sea, may be used to give the vessel's exact location, under a new method developed by the Coast and Geodetic Survey and successfully tried out on the southern California coast. Based upon the fact that water transmits sound at a definite speed, the coast-survey apparatus consists of a means by which the bomb may be fired beneath the water alongside the ship, the exact instant of firing being recorded on an electrical clock equipped with a fountain pen. The shore wireless stations are equipped with hydrophones, or under-water microphones, planted on the sea bottom and connected to the wireless transmitting apparatus by cable. The hydrophones pick up the sound waves from the bomb and broadcast them back to the ship, where the electric clock times the return of the signal. As the time taken for the return of the signal is only a fraction of a second, and the speed of the sound through the water is known, the time the round trip consumes can be reduced to miles traveled by the sound waves under water from ship to shore.

The coast-survey steamer "Guide," which used the method in charting the southern California coast, has its wireless apparatus so arranged that when a switch is turned, the electrical impulse which detonates the bomb is sent, and at the same time a warning signal flashes by radio to the shore stations, while the electric clock records the exact second of time.

Two or more stations on shore are needed to give a cross bearing from which the position of the ship can be calculated, and to prevent their signals returning at the same instant, clogging up the recording clock, time switches are used in the relay between the under-water microphone and the shore station, delaying transmission of the return signal a fixed number of seconds, no two of the clock-driven time switches being timed the same. The number of seconds' delay at each station is known on shipboard, and allowance is made in calculating the time taken by the signal on its round trip.

An entirely different method has been installed by Germany on the Borkum Riff light vessel, in the North Sea, principally for use in time of fog. A submarine sound-broadcasting device transmits the letters BR in Morse code eight times every four minutes, starting six and one-half seconds after every fourth minute of the hour. The radio set of the light vessel at the same time broadcasts the same letters, which in Morse are represented by a dash, four dots, a dash and a dot, but does so only in four-minute periods, starting on the twentieth, thirty-sixth and fifty-second minute of each hour.

The timing is such that the first dash

of the submarine sound signal is transmitted simultaneously with the final dot of the radio signal, but the radio broadcast is then followed by a series of fifteen dots. As a result, if the ship picking up the signal counts the number of dots received by air before the first dash of the submarine signal arrives, the dot on which the two coincide will give the number of miles between ship and light vessel. The time taken by each of the fifteen dots and its interval is 1.253 seconds, approximately the time taken by sound to travel one mile under water. Thus the ship can determine its distance from the light vessel, up to fifteen miles, by merely counting dots. The under-water signals alone will give the receiving ship's position from the light vessel, by means of the direction finder.

Safety Auto Bumper Applies Brakes and Cuts Off Ignition

Automobile bumpers that automatically stop the car by applying the brakes and cutting off the ignition, in case a pedestrian or obstacle is struck, have been demonstrated as an added precaution in the effort to reduce the number of auto accidents. The attachment is placed in about the same position as the usual front bumper and has flexible steel cables connected by crossbars to deaden the shock. The jar of a collision is said to actuate the brake and ignition-control mechanism in such a way that the chauffeur need not operate them and the car stops quickly.

Auto Bumper That Keeps Persons from Falling under Wheels and Also Cuts Off Ignition and Applies Brakes

Soft Rubber Mattress and Pillows Inflated with Air for Comfort

Rubber-fabric mattresses and pillows that are inflated like tires and can be washed with soap and water have been devised by a mid-western company under a process which eliminates the use of stitches, stays, metal washers or other attachments that may work loose and cause leaks. They weigh but little, fold up in small space when deflated and are well adapted to camping, or to home and hospital use. During the manufacture, rubber is squeezed into the fabric under pressure, resulting in a flexible material which is said to stand considerable wear.

Rubber Mattress and Pillow in Use, Showing Corrugated Construction That Adds Strength

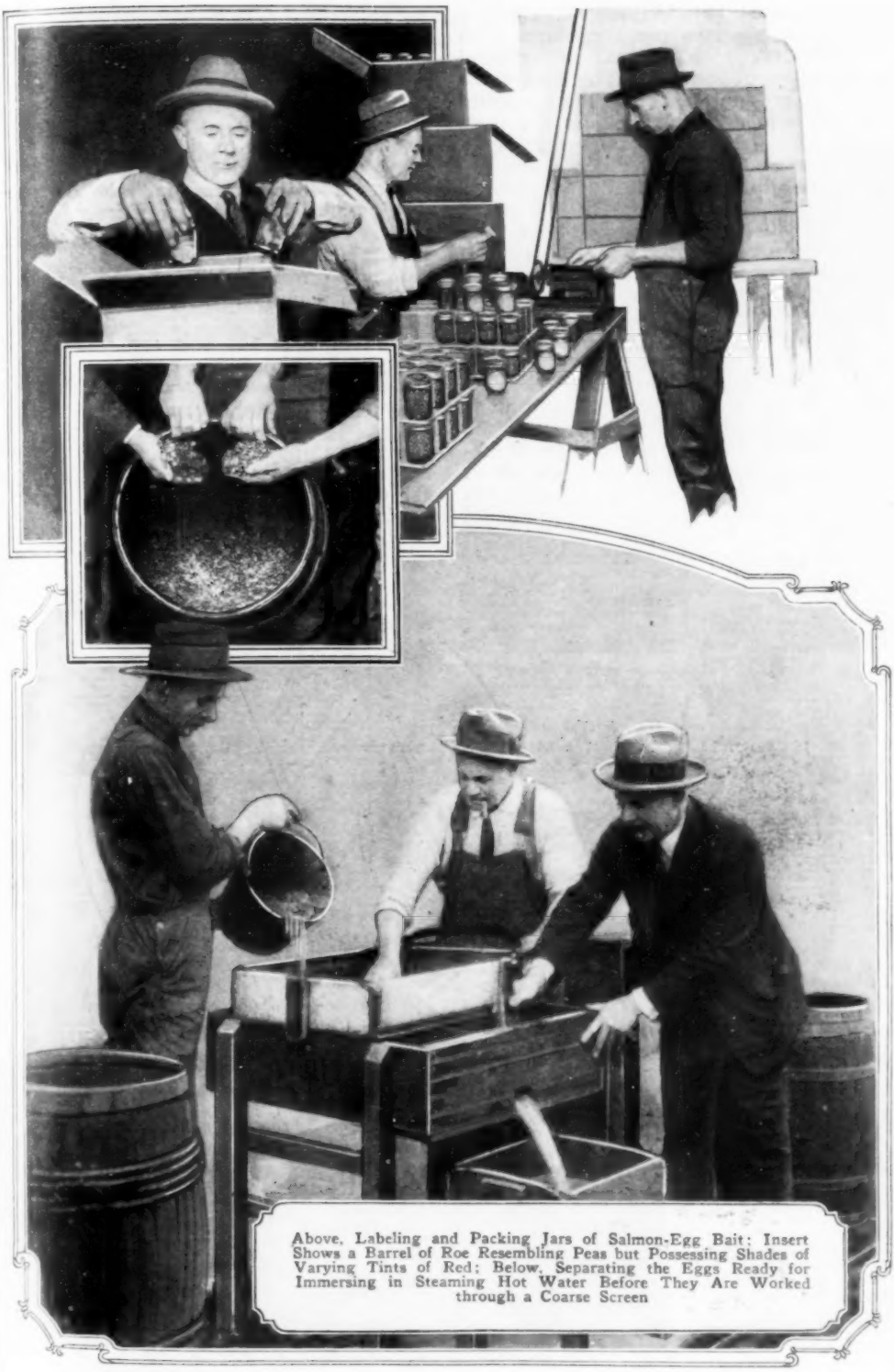
Farms Devoted to Goldfish Culture Supply Yearly Demand

Goldfish farming is a comparatively little known industry but in a Maryland valley, not far from Washington, thirty-five farms are devoted to culture of the fish, and most of the supply for the whole country is obtained here. Something in the water, the vegetation or the climate—scientists have not yet determined what—seems to produce more brilliant colors in the finny creatures here than elsewhere, and in the last ten years it has become the center of the industry, although there are a few farms in other states. Usually the producers plow up the ponds in the fall and sow grass and other crops that provide suitable "pasturage" for the fish, while some "rest" the ponds every other year and depend on natural growth.

Salmon Eggs as Fish Bait Redeem Waste Roe of Canneries

AMONG the industries utilizing what have been considered waste products and converting them into valuable resources is that of the manufacture of salmon roe into fish lures. In the Pacific northwest alone, where the salmon-egg bait industry is centered, more than $1,000,000 worth of this kind of lures are used each season by sportsmen. On the eastern coast and in England, France and the Scandinavian countries, where many large game and commercial fish are found in both salt and fresh water, tests have shown salmon-egg baits to be unusually successful, and the market for this product is extending throughout the world. In four years its manufacture has grown from a few tons, consumed locally, to more than 500 tons, supplying a large demand in all parts of the world. One big plant devoted to this industry produces 150 tons every year. In the hands of the anglers, this amount represents approximately 1,000,000 bottles of bait, costing

Dangling at the End of a Singing Line, the Stubborn Quarry Is Swung from His Sparkling Haunts

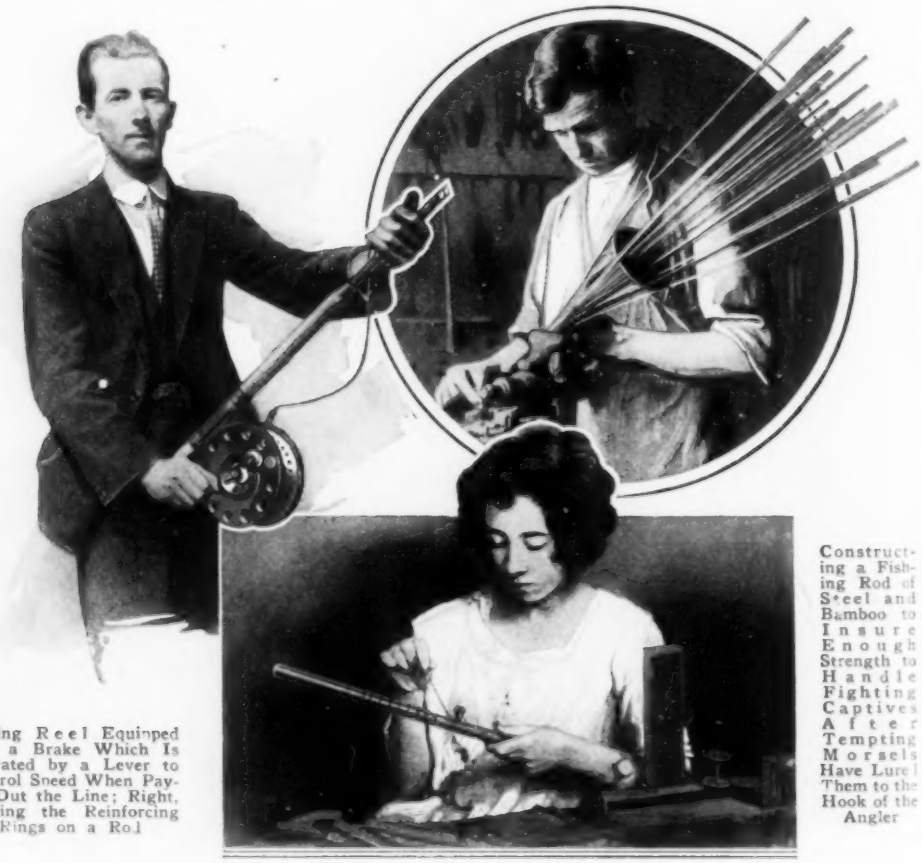


Above, Labeling and Packing Jars of Salmon-Egg Bait; Insert Shows a Barrel of Roe Resembling Peas but Possessing Shades of Varying Tints of Red; Below, Separating the Eggs Ready for Immersing in Steaming Hot Water Before They Are Worked through a Coarse Screen

the fishermen about $350,000. Conversion of salmon roe into prepared lures does not interfere with natural or artificial propagation of the fish. The eggs made into bait are obtained from the canneries and the wholesale plants who get their supplies of fish from boats operating in the open seas several miles from the spawning grounds in the rivers. At the Alaska fisheries, where several hundred million salmon are taken each year, only a small part of the roe is saved for fertilizer by the few canneries which have facilities for handling by-products. The larger number of the plants dump the eggs into the sea as the easiest means of disposing of them.

In a general way, the methods of treating the roe for manufacture into bait is the same. In the final preparation, such as preserving, coloring and like operations, each factory has its own secret process. The maker of one of the brands of salmon-egg bait spent several years and experimented with upward of 400 formulas before he obtained a stage of perfection in manufacture. The finished product must be of natural size and sufficiently tough to stay on a hook without interfering with the ensnaring of the fish. It must also retain the natural oils which exude from it when the bait is dropped into the water. It is the attraction of these oils for the quarry that lure them to the baited hook. Most important of all, the lures are not permitted to contain poison in any form. Strict regulation of this quality is maintained by state game commissions who pass on the legality of prepared baits and their manufacture in accordance with the laws.

Salmon eggs for bait are favored by many fishermen because, differing from most natural lures, they are not difficult to handle. The single bait eggs are canned like peas, and the contents of the packages may be manipulated just as easily. Single bait eggs are used for all kinds of game fish of the salmon and trout species. For the larger specimens, such as steelhead or rainbow, cluster eggs are preferred by many anglers.



Fishing Reel Equipped with a Brake Which Is Operated by a Lever to Control Speed When Paying Out the Line; Right, Binding the Reinforcing Rings on a Rod

Constructing a Fishing Rod of Steel and Bamboo to Insure Enough Strength to Handle Fighting Captives After Tempting Morsels Have Lured Them to the Hook of the Angler

Battle Between Sound Waves Caused to Silence Loud Noises

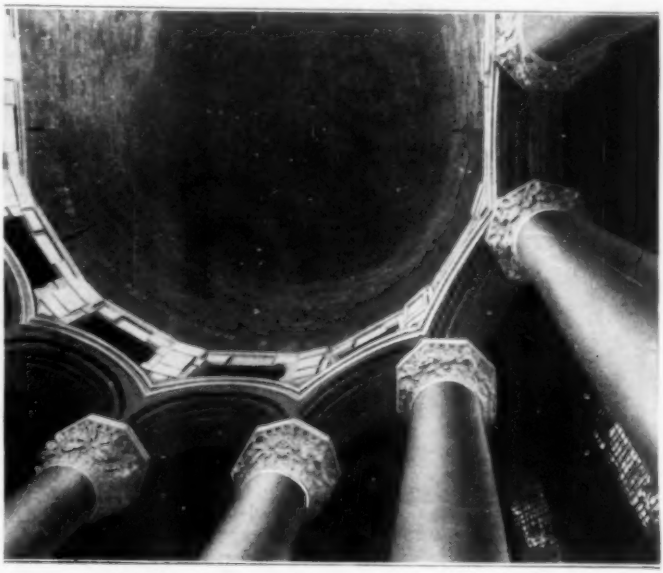
On the theory that the waves that carry different sounds could be placed in conflict with each other to silence loud and objectionable noises, Dr. G. W. Stewart, of the University of Iowa, has devised an instrument which he believes may be successful in muffling some of the din that disturbs our daily lives. His apparatus is a sort of sound filter consisting of a number of branching brass tubes, so arranged that the waves are reflected back upon each other, causing a "battle" that halts their progress. He found that a brass cylinder, open at both ends, half an inch in diameter and six inches long, would transmit all the tones of a piano up to a certain note, but above this no audible sound. Another tube of slightly different proportions seemed to refuse all notes below the pitch at which the other stopped. No obstructions are placed in the tubes, the effect apparently being secured wholly through wave reflection.

Parking Lights in Auto Door Handle Eliminate Extra Attachments

A combined door handle and parking light that will fit any make of automobile replaces the ordinary grip. The bulbs in each end of the hand piece project a strong white light forward, red to the rear, on the left-hand side, and green on the right-hand. Wiring is easily installed and is connected to the battery or starter, and to a switch button on the instrument board. As no wires are run under the car, there is less likelihood of the system getting out of order, and no apparatus is added to complicate the task of washing.

Cathedral's Pillars Rival Heights of World's Loftiest Columns

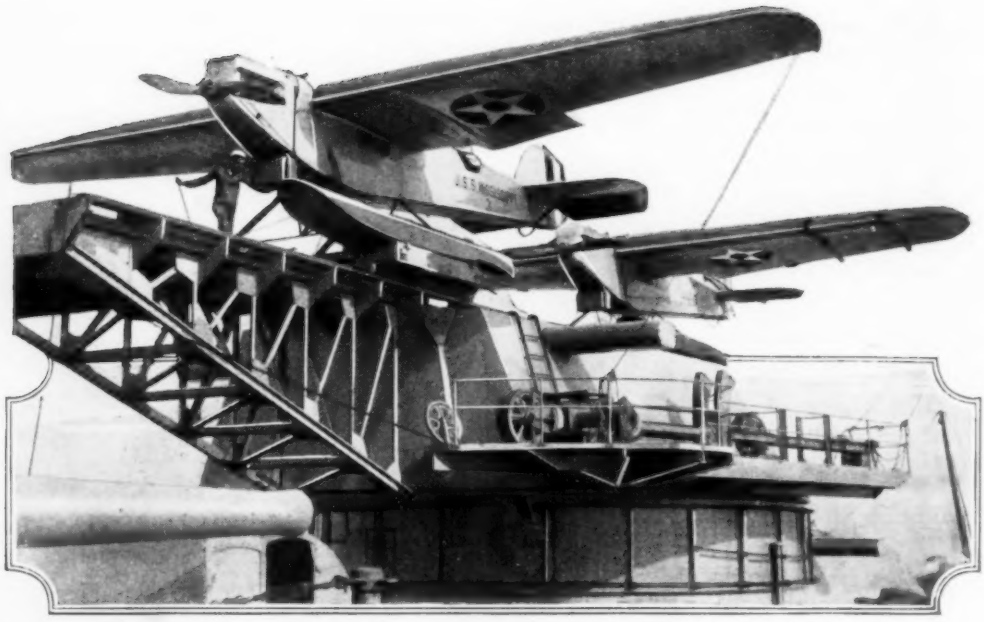
Granite columns supporting a section of the roof of the cathedral of St. John the Divine, in New York, are so high they appear to converge at the ceiling when viewed from the base of the group. Said to be among the largest stone shafts in the world, the pillars are crowned with sculptured caps of light-colored material, the carved figures of which can be clearly distinguished from the floor. Though many edifices of the old world contain similar lofty specimens produced by handcraft centuries ago, modern machinery makes possible the carving and erection of such great pieces in a small fraction of the time formerly required by the cruder methods.



Among the World's Largest Sculptured Shafts of Granite These Imposing Cathedral Columns Seem to Converge at the Roof

Subway Cars Joined like Pullmans to Eliminate Noise

Vestibuled subway cars connected in somewhat the same manner as Pullmans have been planned to eliminate noise, carry more passengers and reduce operating costs. The system is expected to take up slack between the cars, thus insuring smoother stopping and starting; the passageway between them is weather and draft-proof and will make walking from one car to another safe. In addition the comfort of the passengers is increased.



From This Launching Turret on the U. S. S. "Mississippi," Planes Are Sent Skimming Seaward by Firing a Charge of Smokeless Powder, Releasing Apparatus That Acts as a Catapult

Seaplanes Are Shot from Battleships with Smokeless Powder "Gun"

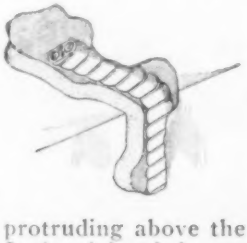
On top of the number three turret of the U. S. S. "Mississippi," a catapult that uses smokeless powder instead of springs and pneumatic pressure has been erected for launching seaplanes from the deck. The entire platform rotates on wheels so that the aircraft can be shot in any direction and the base is large enough to accommodate two planes at one time. Less machinery is said to be required to operate this arrangement than with other types of catapults and the planes receive a powerful flying start the instant the "gun" is discharged.

White Rats Become Puzzle Adepts After Three Months' Schooling

Teaching white rats to work puzzles has been accomplished by Prof. J. F. Dashiell, of the University of North Carolina, by rewarding the victors with food. The experiment, conducted to test the reasoning power of nine rats, was made with a small maze in which three winding paths led from a common starting chamber. Two of the paths were level, but ended in blank walls, while the third was more difficult, leading upward at an angle of thirty degrees, but led to the food. The position of the three in relation to each other was changed at each experiment, and the tests were made with each rat twice a day for 100 days. Scoring was on the basis of both success in finding the food and the time required to solve the puzzle. At the end of 100 days, three of the nine showed marked progress in picking the difficult, inclined path.

Flat Conduit for Electric Wiring Saves Grooves in Walls

Armored cable conduit for electric wiring with less depth than ordinary tubing is being made in flat form to eliminate the need of grooving brick, tile and concrete walls where it is to be carried under plaster coverings. The conduit is flexible and sufficiently thin to prevent it from protruding above the finish on the walls. It is claimed it can be bent in much sharper angles without injury than is possible with the other shapes, and can be used to extend old circuits without requiring deep openings to be made in plaster work.



Roaches Guilty of Eating Books Government Scientists Show

Common cockroaches have been found guilty of destroying the bindings of books. The discovery was made by government chemists during investigations in search of more durable bindings. Cloth-covered volumes were found that appeared to have been left near an open window in the rain or splashed when plants were watered, although they were standing on shelves. Watching for an explanation, the chemists found proof that the roaches moisten the cloth and then feed on the starch, flour, casein and other substances that have been put in to give the fabric stiffness. These attacks caused the blisters and marks that at first mystified the scientists. They are now at work on a treatment for the book cloth which will make it distasteful to the pests.

Push-Button Lock for Auto Ignition Prevents Theft of Car

Easily installed with the dash lamp and lighting switches, a push-button lock for the ignition system of a small car has been invented to afford a certain protection against theft. The attachment is built upon a panel which replaces the standard furnished with the automobile, and the bottom board of the coil box is also to be removed for one with the lock. Pressing the button, automatically closes the ignition and stops the car. A key is needed only to unlock the switch. The device is also designed to prevent the theft of the coils from the box, the wiring is inclosed in a heavy armored cable so that outside current cannot be introduced, and a special switch has been provided to thwart any such attempts. The lock is so designed that if the button is pushed by accident while the car is in motion, no danger or damage can result.

¶Wireless seems to be catching up with wire in Great Britain, according to reports, which show that a million radio sets now are in use there and a million and a quarter of telephones.

Portable Electric Blower Cuts Cost of Cleaning Plant Equipment

Keeping motors, textile machinery and other equipment free from dust is simplified by a portable electric blower, attachable to any convenient electric socket and weighing only seven pounds. The current operates a one-quarter horsepower motor, developing a speed of over 10,000 revolutions per minute, and delivering forty-seven cubic feet of air per minute. Attachments accompanying the cleaner include a suction apparatus, hose and dustbag for other operations. Ridding equipment of dust is an effective way of reducing the fire hazard and lessening wear on machinery, and the portable blower, the inventors claim, provides an economical way of obtaining these results.

Removing Waste and Dangerous Dust from Spinning Machine with Portable Electric Blower

Oilcan Fitted with Flow Regulator Prevents Waste and Leakage

Economy and cleanliness are claimed for an oilcan a western man has devised to eliminate the common faults of the ordinary article. The top has a curved flange and a locking arrangement to prevent leaks, and at the side is a lever so designed that when it is pressed, only a few drops of oil are delivered at one time. An additional feature is a pin-head valve in the spout to keep the contents from running out should the can be tipped over.

Disabled War Veterans Turn Pioneers

Ex-Soldiers under Training Unite in Clearing Overgrown Lands to Make Way for Their Homes and Farms

WITH the same determination and union of effort that marked their actions on battle fronts, groups of disabled war veterans taking vocational training at a Minnesota school, have established thriving farming communities on tracts of land until recently claimed by impassable underbrush and a wilderness of old tree stumps.

To remove the stumpage, the pioneers use picric acid salvaged from reclaimed war explosives and purchase it in carloads to reduce the cost. Where heavy charges fail to entirely remove the stumps, tractors such as were employed in the artillery complete the work. These powerful machines, furnished by the government, also accomplish the plowing for the entire groups. Clearing operations which heretofore have been stopped for the winter months were carried on despite cold and heavy snowfalls, with the result that each planting time found more than 500 acres of new ground ready for spring cultivation.

Now, less than three years after the veterans bought up the land, more than fifty homes have been established in the two settlements of Veteransville and Silver Star. Roads have been opened up through the wilderness, community houses for social and public gatherings have been erected, and more than a thousand acres of ground cleared and placed under cultivation. Several carloads of cattle, horses and sheep have been purchased and distributed to the individual farmers who pool their products for ready markets. To provide instruction in agricultural arts for the veterans, special schools have been organized by the government, and experts train the men in dairying, poultry raising and other phases of farming. Supplies and stock animals are purchased together and products are standardized. All have the same breeds of cows and sheep. Butter and eggs are graded and marked with the official labels of the communities. In this way the highest prices are obtainable for them in the markets.

Even when houses are to be put up, the ex-warriors resort to united action, resulting in great savings of time and labor. At first many of the veterans built log cabins from the timber they cut on their own land. These makeshifts were given over to poultry coops the following year and more elaborate houses were built for permanent dwellings. Isolation, which has caused the failure of many lone settlers, is banished by programs of community activities and outdoor sports.

The work of the former soldiers has caused others to adopt their organized methods in clearing ground throughout that section of the state. Additional veterans' communities have been established until now there are estimated to be more than 500 of these intrepid pioneers who

Blast of Salvaged War Explosive That Uprooted Group of Stumps; Left, One of the Powerful Artillery Tractors Going into Action to Aid in Breaking Down Underbrush

Cozy Home Built by a "Vet" from Logs Cut on His Own Land; Below, Chopping Out Young Trees; Insert, Part of Oat Crop Harvested on Soil Cleared and Worked by Disabled Ex-Soldiers

are blazing new trails and building prosperous settlements on territory they wrest from the tangle of abandoned land, all in spite of physical disabilities. Instead of building individual farms, they are erecting entire communities at once by applying modern methods to an age-old task.

Where certain operations are to be carried out, the work is undertaken by squads of four or more men. Everything is planned beforehand and each step of the task handled with precision. Although in the beginning some of the area could only be reached by narrow footpaths, it was but a matter of days until wagon roads were cut through to accommodate the chugging tractors whose services formed an important part in the uprooting of small trees and the hauling of tools and materials to the scenes of action. If any of the pioneers meet with problems or tasks too difficult for their efforts, a call for aid generally brings a squad of their neighbors to help with the work. And then there is always the tractor to succeed where human energy fails.

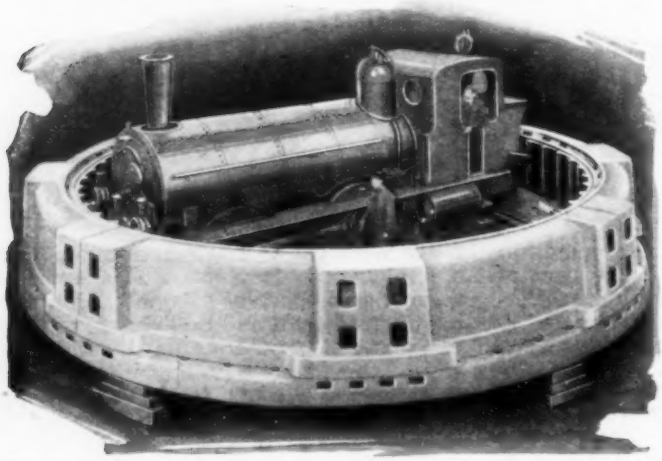
Mirror in Flap on Cuff of Glove Latest Fad of Fashion

With a little mirror inclosed under a flap on the cuff of the back of her glove, a woman can arrange her make-up while on the street without having to open a handbag or vanity case. The glass is concealed and protected by the leather tab, which snaps down over it.

Using Make-Up Mirror on Glove Cuff, Where It Is Always Ready and Easily Reached

Armature for Russian Power Plant Big Enough to Hold Engine

The size of some of the equipment for the light and power plant being erected at Leningrad, Russia, was illustrated when a locomotive was fitted inside one of the huge armatures for the dynamos. There was a foot or so of space to spare at each end of the engine. Four large units, each with a capacity of 8,750 kilowatts at 11,000 volts, are part of the installation, which is being made by a Swedish company.



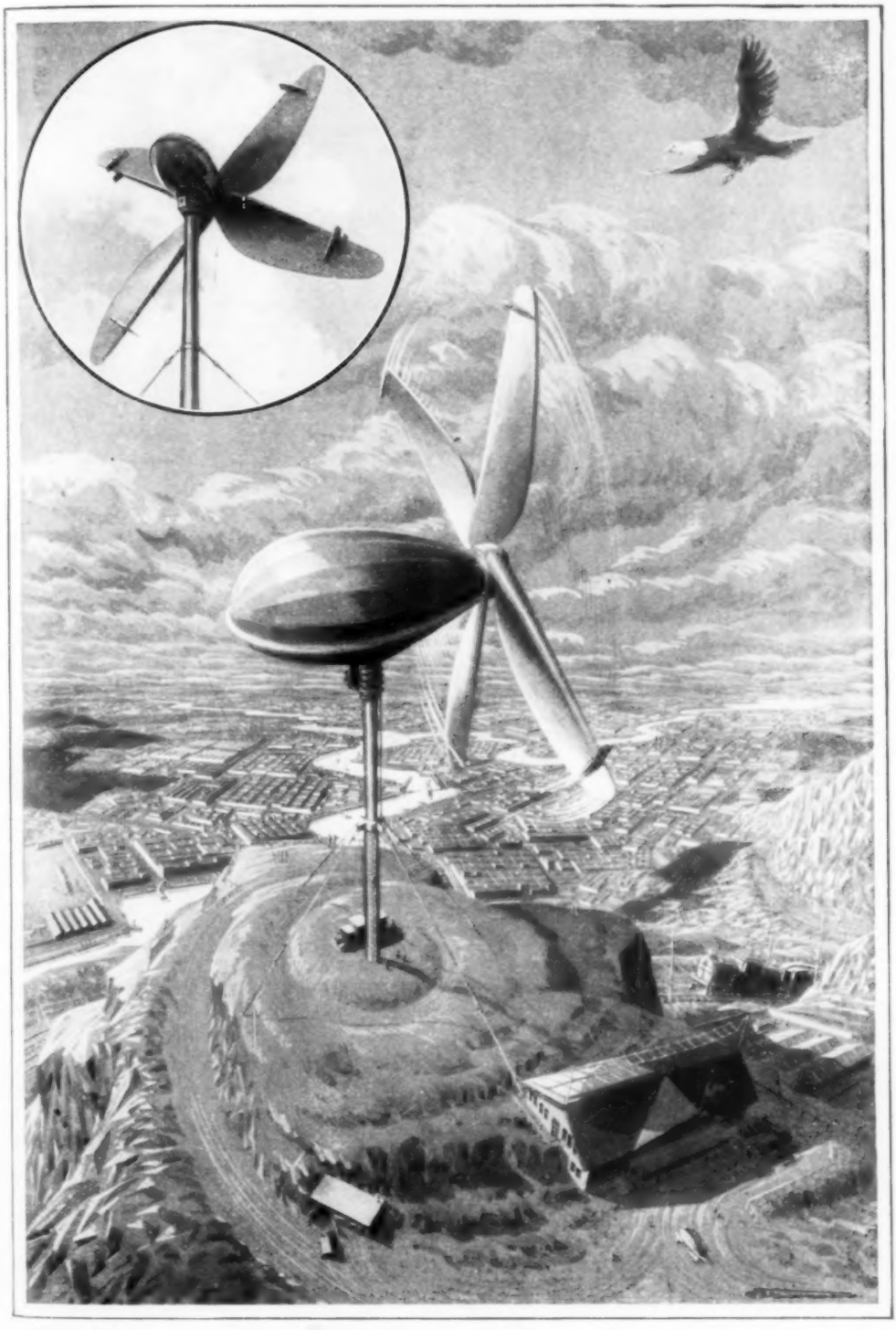
Part of the Plant That Will Have Power of Many Engines, the Giant Armature Holding a Locomotive

Aero Dynamo Designed to Produce Electricity for Farms

An aero dynamo, driven by a propeller nearly thirty feet in diameter, has been designed by a German officer, who intends it for use on farms or other points far removed from central generating systems. The device is unusual in that the dynamo is concealed in the wind head, which is streamlined like a large raindrop. The four-blade propeller follows the latest practice in aerodynamics, and is so built that it reacts to the slightest wind. The whole plant is portable and can be erected in six hours. The first tests of the machines were very successful, according to reports from Germany.

Elephant's Appetite Calls for Food Twenty-Three Hours a Day

Elephants apparently have appetites in keeping with their size for in India about twenty-three hours out of the twenty-four are consumed in eating and one or more men are employed to keep them in food. This consists of grass, boughs of trees and grain and huge cakes, called "chupatty," each about two and one-half feet in diameter and an inch and a half thick. They are made of coarse ground meal and are relished by the Indian natives themselves. The mahouts become greatly attached to their beasts. They entertain many superstitions regarding their charges and are said to use a special "elephant language." The number of hairs on the animals' tails and the color and position of their toenails are believed to be signs of good or bad luck. In spite of their great bulk, elephants are capable of considerable speed and can carry loads up to 1,000 pounds through the roughest country.



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Four Blades Shaped like an Airplane Propeller Drive This German Self-Contained Aero Dynamo, Designed for Use on Farms; the Dynamo, Direct-Connected, Is Carried in the Egg-Shaped Tail

"Take Chances and Wear These," Said the "Devil," Rattling the Eyes and Wooden Leg

"Try a Glass Eye or Wooden Leg," Teaches Safety-First Lesson

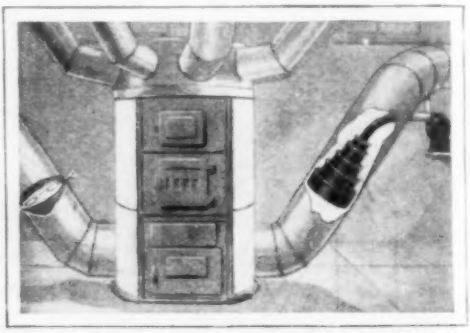
"How would you like to wear a nice glass eye and travel around the shop for the rest of your life on a wooden leg?" This question startled workmen at a cement plant as a man, attired to represent the devil and carrying samples of the artificial equipment he referred to, approached them with the query. He rattled the eyes and shook the leg to make his message more forceful. The "stunt" was part of a safety drive the company conducted to decrease accidents, and proved an effective method of teaching the folly of taking chances.

Raw-Rubber Problem Causes Hunt for New Sources of Supply

With a predicted output of 56,000,000 automobile tires for 1925, in the United States alone, government bureaus are striving to find rubber-bearing plants suitable for cultivation in the semitropic soils of this country and its island possessions. All the raw material consumed by the rubber industries now must be imported, and in case of war, the sources might be easily cut off. To replace this great volume, several bureaus are devoting their attention to experimenting with native plants of the south which might offer a means of cultivating a home-grown variety. Various tropical growths of South America have been transplanted to the Panama canal zone where they thrived to such an extent as to make possible the planting of large crops in that region. The Philippine islands are said also to offer suitable land for the raising of different forms of rubber trees. Large sections of several of the southern states are believed to be favorable to the raising of such plants, although the species most fitted for cultivation in these districts may require special processes and machinery to extract the raw product.

Circulator for Warm-Air Furnaces Spreads Heat and Saves Fuel

By increasing the flow of heat from a warm-air furnace, a motor-driven circulator, which can be connected to an electric-light socket, is claimed to greatly aid in its even distribution to all parts of a building. As it is unnecessary to "force" the fire to obtain a heavy volume of draft, it is said a large saving in fuel can be effected. To obtain an immediate flow of warm air, the device can operate with an ordinary amount of heat being produced by the furnace. Where it is desired to start the plant quickly, the circulator can be employed to induce natural draft and switched off when the heater has reached a point of full production. If idle, the apparatus is said to present no obstruction to the free movement of warm air through that part of the system in which it is installed.



Circulator Installed in Pipe of Warm-Air Furnace to Induce Draft and Distribute Heat Evenly

Testing Teletype Printers, with the Entire Battery Writing a Sample Sentence Sent Over and Over Again All Day Long from One Sending Machine

Radio Shoots Typed Words through Space

Automatic Typewriter Delivers Written Message Flashed in Secret through Ether from Keyboard Many Miles Away

SECRET wireless is an actuality, the necessity of learning the telegraph code has been eliminated, and the receiving operator may be dispensed with, as a result of experiments conducted during the last two years by a company manufacturing printing-telegraph equipment for press associations and telegraph companies, and for intercommunication in banks, hotels and other large organizations.

Using the regular typing-telegraph instruments, with radio substituted for land wires, the company's engineers have maintained communication between Chicago and Milwaukee, Wis., Chicago and Indianapolis and Lafayette, Ind., and between Chicago and an experimental laboratory thirty miles west of the city, at Lisle, Ill. At the transmitting station, a message written at an ordinary typewriter keyboard is automatically broadcast by a continuous-wave tube set, transmitting on a wave length of 1,300 meters, or a frequency of 230.7 kilocycles. At the receiving end, the signals are picked up by a special set and passed through delicate relays to another automatic typewriter printer. The signals which transmit the message resemble telegraph code, if you listen in on them—until you try to decode them. Then they bear no resemblance to any known code system. The system used is a five-unit code. If a given unit of time is divided into five intervals, during which current may or may not be transmitted, it is possible to produce thirty-two code combinations of current and no-current intervals. In one of the telegraph machines used in the radio experiments, pressure on the typewriter keys closes various combinations of five switch fingers in a revolving switch to transmit the code

combinations. In another, and still faster machine, typing of the message punches groups of little holes in a moving tape, which then passes through a transmitter where contact points close circuits through the perforations. Both devices have been used interchangeably in the experiments. The tape transmitter has several other advantages besides greater speed. Tape can be prepared in advance of transmission and run through the transmitter later without the necessity of an operator being present, and tape can be re-run if it is necessary to repeat any part of a message.

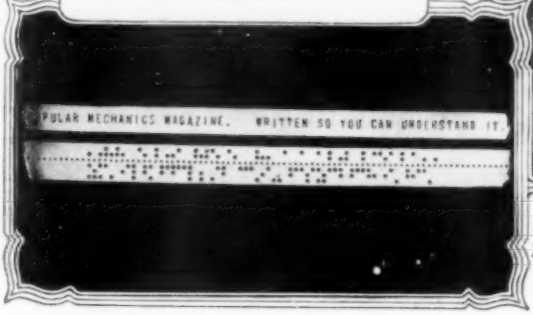
Radio fans who have had trouble tuning out interfering stations would find the receiving outfit a joy forever. It has been developed to a point where tuning is so fine that no outside station has been heard for periods of months. In fact, both the transmitting and receiving sets are so perfectly adjusted that they have operated month after month without ever being touched. The engineers simply turn on the current to start and turn it off in the evening. At the transmitting end, a motor generator supplies a 2,000-volt direct current for the plate circuit of the 750-watt transmitting tubes. The filaments of the tubes are lighted by a 12-volt alternating current. The commutator ripple of the direct-current generator is smoothed out by a filter which gives a pure continuous-wave signal at any distance from the transmitter, with no generator hum noticeable. This purity of signal is one of the important features of the radio typewriter because the relays used at the receiving stations are tuned to the heterodyned note of the sending station. For transmitting at the factory a 256-foot cage aerial, consisting of six phosphor-bronze wires, is suspended eighty feet above the ground. A counterpoise strung below it, and a network of copper ground wires, buried in moist earth, complete the antenna. From the telegraph printer the current passes to a special telegraph relay, with contacts adjusted to carry the heavy broadcasting current. The transmitting equipment itself is practically a standard telegraph outfit, with distributor for sending the signals, tape transmitter, tape perforator with keyboard, and teletype printer, which sends without the tape. In addition there is a Morse key, so that the operator can send the station call letters at intervals, as required by law, to let listeners know who is sending. The set is

Two Radio Typewriters, One Producing a Tape Copy and the Other an Endless Page

Receiver That Picks Up the Signals and Transmits Them through Relay on Top

Synchronizing Motor on Printer by Checking Spots on Governor with Tuning Fork

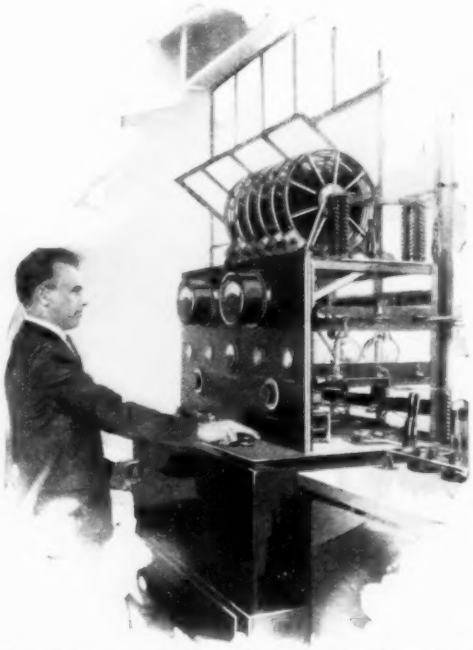
Writing Message by Punching the Tape, Which Passes through the Sending Apparatus at Left; Below, Code Tape and Its Message Translated



The Printer at the Receiving End Picks Up the Signals from the Relay of the Receiver and Prints Them on Tape in Plain English

so arranged that when the tape transmitter is sending, the teletype receiving unit makes a copy of the message for the home office, and for comparison with the copy received at the distant radio station.

To radio fans, the chief interest lies in the distant receiver. One of those in use at present employs a special receiving set, relay and printer. The radio set employs an indoor loop aerial, intermediate circuit tuner, three stages of untuned radio-frequency amplification, detector, two stages of audio amplification and a separate heterodyne. Besides being very stable and requiring no adjustment over long periods of time, the set is not affected by changes in A or B-battery voltages. The signals received are heterodyned to a frequency of 1,200 cycles, and the relay sharply tuned to this audible note, the signal being further amplified by the tubes of the radio relay, which pass it on to a mechanical telegraph relay, and that in turn actuates a polar relay which finally passes the signal to the selectors of the printer.



The Transmitter Used to Send Out the Typewritten Message in the Form of Code Dots

A special circuit has been devised which, it is claimed, practically eliminates static or other interference with the receiving set. Tests have shown that static below the intensity that paralyzes the vacuum tubes, even though it is louder than the signal, will not cause the printer to make errors, and that interference and other noises cause correspondingly less trouble. In extended tests, the operation of the radio printer has proved very stable. During eight-hour runs, the accuracy has been close to 100 per cent. One wrong letter in 60,000 letters has been the mark achieved, even under midsummer conditions, while another test gave three wrong letters in 90,000 letters.

In the tests a strip of perforated tape is prepared with a sentence employing every letter of the alphabet, and all the numerals. The sentence reads: "A quick movement of the enemy would jeopardize six gunboats, 1234567890." The ends of the strip are then pasted together and it is inserted in the tape transmitter where it goes round and round hour after hour sending the sentence over and over again all day long. The only break in the routine is to send the station's call letters at intervals.

The company is working primarily to perfect the apparatus for use of newspaper and press associations, and here the element of secrecy which it affords is all-important. Radio has not been generally utilized in news transmission, despite the rigid laws regulating secrecy of wireless messages and court decisions upholding the press associations' property right in their news. It is absolutely impossible to read the signals of the new radio printer by ear, and the five-unit system offers combinations, which can be changed at will so as to defy even a code expert with a machine that is not set to the same combination.

The task of pirating is further complicated by the fact that the motors operating the sending and receiving printers must run at the same speed, and the listener would not only have to know the code, but have the correct motor speed before his printer could pick up the message. The motor speeds are so exactly adjusted that a tuning fork is used to keep the machines synchronized. Two strips of steel are attached to the prongs of the fork, with a tiny slot in one strip. As the fork is vibrated the slot is alternately exposed and concealed, the rate depending upon the known vibratory rate of the fork. On the governor of the printer motor a row of white dots is painted, and when the operator looks through his vibrating tuning fork the slot is exposed just often enough for the eye to see the dots, provided the motor speed is correct.

Starting Limited Train Requires Effort of Thousand Men

With the start of a limited train of the type featured by many of the country's leading railroads, approximately a thousand watchful workers are affected in the routine of duty. Long before the time for departure, hundreds of these are busy preparing cars, engines, and signals, and scrutinizing tracks and switches to insure its unimpeded progress. As the train pulls out on its journey, a wave of orders and information is sent pulsing to stations, offices, towers, roundhouses and even into the homes of those who, several hundred miles in advance, are charged with its care and operation along the way. Equipment is assembled hours before leaving time, and as the limited is made up at its source, directions are sent ahead for various relief crews, diner supplies, and above all to see that powerful engines in perfect condition will be standing at division points ready to take up the race when others are withdrawn. An army of trackmen is constantly on the lookout for defective rails, and roadbeds are continually being repaired and improved to avoid accident and delay to the through-express trains.

Violin Sounding-Board Attachment Produces Rare Tones

Tones of the violin are said to be mellowed and enriched with the aid of a wooden attachment shaped much like the instrument itself and placed on the underside of the top. It is prepared by a special treating process and carefully cut and formed to suit the size and contour of the violin, and is accurately adjusted to give the desired results. Similar boards are made for other stringed instruments.

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Violin Sounding Board and How It Is Attached to Underside of Instrument's Top

Seed Planter Operated by Hand Quickly Sows Gardens

To insure accuracy and prevent crowding and choking of growths, a hand-operated seeder devised to save time and labor of measuring and marking when planting a garden, deposits a single seed as a release is touched by the worker's finger. Any-size grain can be scattered with the planter, which is easily guided along marked furrows or used to trace designs in the soil with seeds. The point is constructed for use as a digging tool for soft earth and, where desired, may be employed to make troughs and holes in which the grains are to be placed.

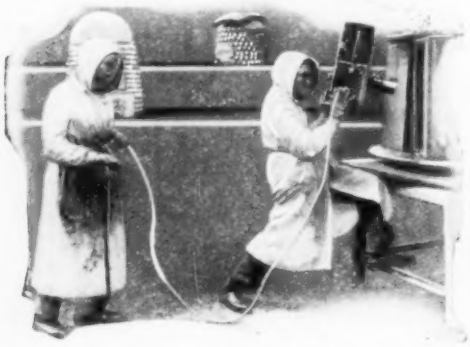
Sowing a Window-Box Garden with a Hand Planter That Scatters Seeds Evenly

Tilt Battleships to Elevate Guns Is the Plan of Edison

Guns on United States battleships can be elevated without the installation of costly equipment according to Thomas A. Edison, who has announced a substitute for the proposed method for which an appropriation of $6,500,000 was asked. All that is needed, he says, is a pound of mercury to a ship and an apparatus somewhat like a lateral fin or rudder by which the boat could be tilted to alter the range of the guns. The working principle is similar to that used by submarines in diving or coming to the surface.

Life Drama of the Bee Is Filmed by Cameramen in Masks

One of the chief difficulties of obtaining realistic motion pictures of bees at work



Using Masks and Extension-Crank Camera While Taking Motion Pictures of Bees at Work

in the hive is that the insects become disturbed at the approach of the camera and their normal activities cannot be studied. To overcome this, a movie camera was devised that could be strapped to the shoulders of one of the operators and held close to the hive while the crank was turned by means of an extension handle intrusted to another. With this arrangement, the bees were not excited by the movements of the arm and hand of the photographer.

Chinchilla Is Fast Disappearing as Result of Demand for Fur

From a supply of 32,000 dozens of chinchilla skins exported by Chile in 1898, the production of this fur has decreased to less than 150 pelts a year, owing to the rapidity with which the animals have been killed off. They are found only at the tops of the highest mountain ranges in South America, where snows and low temperatures prevail the year round, and hunters face extreme hardships to trap the valuable creatures. Less than thirty years ago, a market price of only twenty-five cents each was paid for the hides, but this figure has increased with leaps and bounds until more than $90 a pelt is demanded by the trappers fortunate enough to capture a few of the animals. Many attempts to rear them in captivity have failed because of the high altitudes necessary to their life. Two of them, said to be the only pair in captivity, are owned by a governor of a Mexican province who keeps them at a point more than 12,000 feet above sea level. Though the countries in which the chinchilla is found have passed stern laws limiting their capture, ruthless Indian hunters of the Andes mountains seek them sometimes with dogs, braving the worst weather conditions to secure the high prices that are offered for the skins in all the fur markets of the world.

Supercharger for Racer Motors Works Like Blower

Tearing down the course at the rate of 115 miles an hour, with its motor making 5,000 revolutions a minute, a racing automobile may have difficulty in getting a full charge of gas all the time, because the pistons are moving so fast that there is a tendency to create a vacuum in the manifold. To correct this, a supercharger has been invented which operates like a blower and gives the combustion chambers a full dose of fuel by increasing the pressure of the gas at the valves. With this attachment, it has been found unnecessary to introduce a carburetor for each cylinder, a plan that was previously used to obtain high racing speeds. Records made not long ago at Culver City, Calif., were partly due to a blower of this type, experts say.

Close View of Supercharger Showing Its Blowerlike Construction, and Position It Occupies When Installed in Racer

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Battery of Verifying Counting Devices Which Prove the Figures Computed by the Automatic Calculators

"Steel Brains" Figure Bonus Millions

Battery of Mechanical Calculators Replace Army of Clerks to Compute Accounts for Government Compensation Bureau

"STEEL brains" have been enlisted by the government to do the work of an army of statisticians in figuring the bonus payments due 4,600,000 World War veterans. Facing a problem of staggering proportions, Uncle Sam has devised machines for figuring these allowances—mechanical brains performing the various computing processes from determining the amount of money due each former service man to that of automatically stamping the signature of Major General Robert C. Davis, adjutant general of the army, on the completed certificate. Instead of an army of statisticians and clerks, with reams of paper and pencils by the gross, engaged in making calculations, a battery of automatic adding and subtracting machines are figuring the precise sum each individual is entitled to. That is, sixty-five of these machines, with as many operators, can handle 40,000 applications a day. Without these machines the gigantic task would need the services of at least 300 additional clerks in the war department, and the output, even then, would not measure up to the machine production. The various stages of the calculating process are likely to engage the interest of bankers, business men, industrialists, merchants, paymasters and statisticians everywhere. If you are entitled to a bonus under the Adjusted Compensation Act and

Close-Up of a Machine with Which Both Home and Overseas Services Are Figured

have filed an application, you will be doubly interested.

Upon receiving your application, it is examined by the department, and if it contains the proper information, receipt is acknowledged. The fingerprints and information on the application are compared with those in the official records of the applicant on file in the department. If any discrepancy between the two is found, the case is referred to the investigation and determination section.

Once the identity and war record of the applicant have been established, the essential facts are entered on a certificate. Then the application and certificate are referred to a reviewer for a second examination, after which the two documents go to the computing section. Here, by means of a simple code and the battery of machines, the amount of each war veteran's compensation is determined. This figuring is done automatically. There are, of course, several types and sizes of machines; some for calculating home service, overseas service, and duty performed upon the applicant's return from overseas, and others that compute home or overseas service only. As fast as these operations are completed, the printed record of the work accomplished by the machines is torn off and attached to the certificate. Then the total number of days the applicant was on duty and the amount of money due him are entered on the certificate from the printed record. At this stage of the process, all the papers are referred to the verifying section, where the computations and transcribing are again checked for accuracy, and finally the application with attached documents goes to the authentification section where the signature of the adjutant general is affixed automatically. The certificate of application is then ready for consignment to the veterans' bureau where all compensation policies are prepared.

The checking done in the verifying section is also performed by machines, fast-figuring calculators which were specified by the government as necessary in connection with the automatic adding and subtracting machines.

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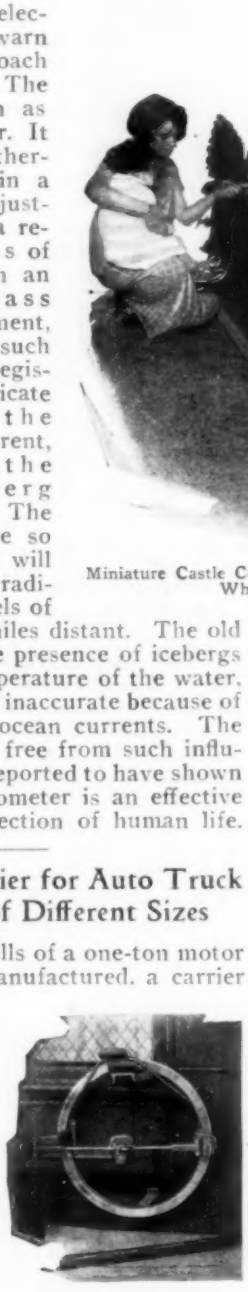
With the Group of Busy "Steel Brains" Above, the Amounts of Compensation Due World War Veterans Are Determined; Below, Experts Are Comparing Fingerprints to Certify Applications

Heat Radiated by Icebergs Is Used to Warn Ships of Their Approach

Although icebergs seem cold by contrast with the air around them, they nevertheless radiate heat and this is used in an electrical mechanism to warn vessels of the approach of the ice masses. The apparatus is known as the radio micrometer. It consists of a tiny thermocouple inclosed in a vacuum tube and adjusted in the focus of a reflector. The waves of radiant energy from an iceberg as they pass through the instrument, are concentrated in such a way that they are registered upon a delicate galvanometer. By the strength of the current, both the size and the proximity of the berg can be determined. The device is said to be so sensitive that it will show the effect of radiation from the funnels of an ocean liner six miles distant. The old way of detecting the presence of icebergs was to take the temperature of the water, but this proved to be inaccurate because of winds and shifting ocean currents. The electrical method is free from such influences and tests are reported to have shown that the radio micrometer is an effective means for the protection of human life.

Double Tire Carrier for Auto Truck Holds Spares of Different Sizes

Mounted on the sills of a one-ton motor truck now being manufactured, a carrier has been devised to hold two rims and two spare tires of different sizes for the front and rear wheels. It is operated by pushing in two toggle arms to release the tires and closing them somewhat after the fashion of the ribs of an umbrella to lock the spares in place. Nothing touches the rubber.



Toy Castle of Cardboard Masonry Copies Ancient Citadels

A miniature citadel of cardboard, patterned after the feudal strongholds of the middle ages and equipped with electric lights to give it a modern finish, has been built by an artist who devoted his spare moments to the task for four years. The framework of the toy castle consists of bits of wood and other light materials, but the walls and turreted towers are formed of pasteboard squares that resemble cut stone. The little structure is surrounded by a grove of artificial trees and bushes, in the midst of which is a small pool of water containing live fishes to add a touch of realism. Toy cannon and a model of an airplane serve to put a warlike appearance on the scene.

Miniature Castle Constructed from Cardboard and Set in an Artificial Grove Which Is Illuminated by Toy Electric Lights

Friendly Germs Made into Serum to War on Disease

Germs, too small to be seen even under the microscope, which war on disease-producing organisms, are reported to have been discovered at the University of Minnesota. They are parasites, living on the bacteria that cause pneumonia, typhoid fever, diphtheria, anthrax, chicken cholera and other ailments. These friendly germs have been made into a serum to kill all the bacteria that prey on man or beast except that of tuberculosis.

Memorial Bridge to Span Potomac Will Take Ten Years to Build

One of the most beautiful and costly bridges in the world is reported to be planned to span the Potomac river to connect the Lincoln Memorial in Washington with the Arlington Amphitheater in Virginia. The cost of erecting the gigantic structure is expected to reach more than $14,000,000, and it will require at least ten years to complete the work. The expense will be borne by the government under whose direction the plans have been made. The bridge, it is said, will greatly reduce the travel distance between the two points, which are centers of interest for visitors and tourists, and the scenes of elaborate patriotic ceremonies conducted by officials of the government.

Architect's Painting of Monumental Memorial Bridge Proposed for Erection across the Potomac between Washington and Arlington

Motorcycle Taxi-Sleds Solve Northern Snow Problem

Motorcycle taxis, equipped with sidecars and runners, have solved the winter passenger-carrying problem in northern Wisconsin, where the snow lies deep throughout the cold months. Several of the taxi-sleds operated at Barron, Wis., as public conveyances easily earn an average of $10 a day, while others are supplied to doctors for making their professional calls, and to other business men. The front wheel tire is removed and the rim fitted with a sled runner, which is bolted in place. The sidecar also is fitted with a runner, which is bolted to the frame and set to travel in a sleigh track. Both runners are designed to oscillate freely. The rear tire of the cycle is left in place, and fitted with a heavy, non-skid chain. The final step is to reduce the gear ratio about twenty-five per cent by a simple change of sprockets. Despite the gear reduction, the speed of the taxi-sled is about the same as that of the motorcycle in summer. One hour suffices to make the change from cycle to sled. Wind screens with curtains of leather and glass windows protect both driver and passenger from the worst of the northern weather.

Winter Taxicab in Frozen Northern Wisconsin

Value of Alaska's Reindeer Herds More than U. S. Paid for Land

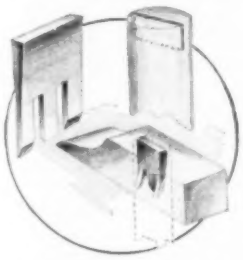
The domestic reindeer industry of Alaska is now valued at $9,750,000, a sum $1,550,000 greater than the price paid for the territory by this government in 1867. It is estimated that the total stock of the animals on the ranges of breeders is about 350,000, of which more than two-thirds are owned by natives. Not only food and clothing for a large part of the population are furnished from the deer, but their care and marketing afford a means of livelihood for a great army of workers. Efforts are being made to improve the present methods of handling the increasing herds and also to find a cheaper process of marketing the various products. Venison from the reindeer is rapidly becoming a regular item on the menus of restaurants throughout the northwest, and its use as an article of food is becoming quite popular in the larger cities of this country.

Weapon Museum for Movie Studio Supplies Thrills for Films

Rifles and revolvers enough to supply a battalion of infantry and collections of antiquated blunderbusses and flintlocks that any museum would prize, can be found in modern motion-picture studios, important trappings that give "punch" to western stories and realism to historical dramas. One studio boasts 1,200 rifles of all calibers and 400 pistols and revolvers, including a pocket pistol of French design with a spring dagger attached to the barrel, the forerunner of the modern bayonet. Some of the weapons were in actual service in wars and frontier skirmishes, playing their parts in the winning of the west. The prized possession of one director is a Chinese rifle with a carved-ivory grip, on the hexagonal steel barrel of which is depicted in gold inlay what is said to be the story of the Crucifixion. A rifle shown in the "Covered Wagon" belonged to a famous Kentucky family. In "North of 36" a rare six-shot rifle, a "parent" of the present repeater, was used.

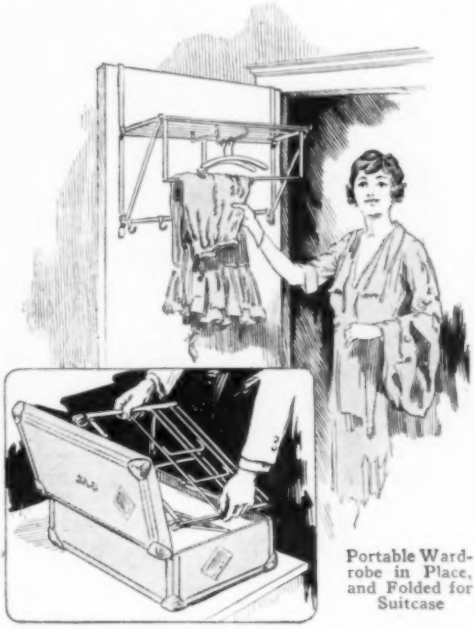
Three-Pronged Wedge for Hammers Locks Head from Slipping

Handles on hammers, axes and other tools can be secured with reasonable safety with almost any kind of wedge, but few of the ordinary makeshifts, such as chips of wood or nails, last long. A pronged wedge has now been patented that is said to lock so tightly as it is driven in, that it is next to impossible for the head to fly off. It is made of malleable iron and the prongs are bent in opposite directions alternately so that when the wedge is forced into the wood, the three "teeth" bend outward, gripping so firmly that they seldom become dislodged under ordinary service.



Folding Wardrobe Requires No Nails and Fits in Suitcase

A folding wardrobe, which can be hung from the top edge of a door, requires no nails or hooks to hold it in place. A few light taps with a heavy object are sufficient to fasten it firmly in position and it does not interfere with the opening and closing of the door. Small enough to be carried in a suitcase among other articles, the device can be used by travelers and campers.



Portable Wardrobe in Place, and Folded for Suitcase

Both shelves and hangers are provided on the rack, to accommodate various articles of wearing apparel. It is made of aluminum and is proof against rust.

Auto Gasoline Gauge with Humps Is Easily Read at Night

Difficulties of measuring the contents of the auto gasoline tank at night and the danger of striking matches are eliminated with a gauge now on the market that has three humps and an upturned arrow on its outside surface, whereby the amount of fuel can be determined by the sense of touch. The three projections indicate full, half full and empty, respectively. The arrow's position is regulated by the contents of the tank and its distance from any one of the three humps can easily be determined by passing the finger over the dial. The pointer also shows at a glance in daytime if more gasoline is needed.

Harold Osborne, World's Champion High Jumper, Using the So-Called "Western Roll" to Clear the Bar in the Highest Jump Ever Made by Any Athlete

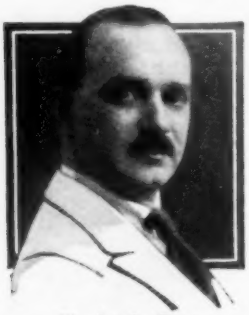
Science and Sports Records

World's Marks Continue to Fall as Men Master Nature to Improve Form and Technique and Obtain Better Equipment

By CHARLES A. DEAN

(Former President National and Central A. A. U. and Manager of the American Team at the 1924 Olympic Games)

WHEN if ever, will men reach the ultimate limit of physical endurance and cease making new world's records in sports? For two decades records in virtually every field of athletics for both men and women have been broken, in some cases with almost monotonous regularity, and yet the end is not in sight. That the runners and jumpers, the swimmers and the discus and javelin throwers of the present are produced from better raw material than in the past has not been proved. Instead, the new records may usually be traced to new applications of scientific laws for the improvement of equipment and for better physical training.



Charles A. Dean

The invention of the so-called "lively ball" made Babe Ruth the "King of Swat," because it gave the batter an advantage over the pitcher. Application of science to pitching had in the same way put the batter at a disadvantage for many years. The modern golf ball and improved clubs made golf a popular sport because science had so improved on the old Scottish game that the player got the satisfying thrill of long-distance shots, and similar improvements in tennis racquets have added to the interest in that game.

Since 1895 a fifth of a second has been clipped off the 100-yard dash record, and the mark for 220 yards has been reduced four-fifths of a second. The two records have been tied several times. The last man to do it was Charley Paddock, the California flash, who has devoted his life to sprinting. He has trained himself until he has become a perfect speed automaton, with mind and muscle under absolute control. His movements are worked out with the utmost care, and when he

The Straight Leg and Trick of Raising the Back Knee Have Made Fourteen Seconds Possible for the 120-Yard Hurdlers, Allowing Two Seconds for Jumping Ten Hurdles

Scientific Training, Better Tracks and Improved Shoes Are Aids to Runners

Alfred Leconey, of Philadelphia, Beating Harold Abrahams, British Star

Miss Helen Wills Was a Champion at Seventeen Because of Hard Training and an Improved Racquet

runs, it is with the precision and smoothness of a perfect piece of machinery. In every branch of sport where records are being broken, it is such machinelike precision, or else improvement of equipment, that has made the new marks possible. An English athletic coach is now working on a one-piece, foot-form athletic shoe, which will give both sprinters and jumpers such a prehensile grip upon the ground that it is bound to improve their performance, just as the wide shoe, with slightly curved soles, developed by the Finns, has enabled their javelin and discus throwers to set new world's records.

Bodily performance is largely a question of physical capacity. The jumper has but a certain length of muscle to contract, and the runner only capacity for energy to drive his body along at a certain speed. Yet with better co-ordination of mind and muscle, improved tracks and better shoes, runners are constantly bettering the performances of the past. This increased power of athletes is demonstrated by each succeeding generation of Olympic champions. That these men are able to continue breaking records is due to greater knowledge of technique, and, consequently, improved methods, more specialized physical development and more scientifically prepared equipment. At the time of the 1908 games in London, javelins with English ash shafts and unwieldy ringed discuses were used. The world's record for the javelin throw then stood at something short of 180 feet. It has since been increased to over 216 feet, and the increase is largely due to the discovery by the Finns that a stiff-shafted javelin, fashioned from the best outside layer of the sunny side of a Finnish birch tree, will travel some thirty feet farther than will a weapon shafted with English ash. The grain of the ash shaft is subject to considerable vibration while in flight through the air, and this vibration absorbs part of the power which the thrower has put into the weapon. The Finnish birch shaft is not subject to such vibration, and hence all the energy imparted to the javelin is expended in carrying it a greater distance. With the birch javelin the Finnish team won first, second, third and fourth place in the games of 1920, at Antwerp. In 1924, when the Olympic committee specified the kind of shaft to be

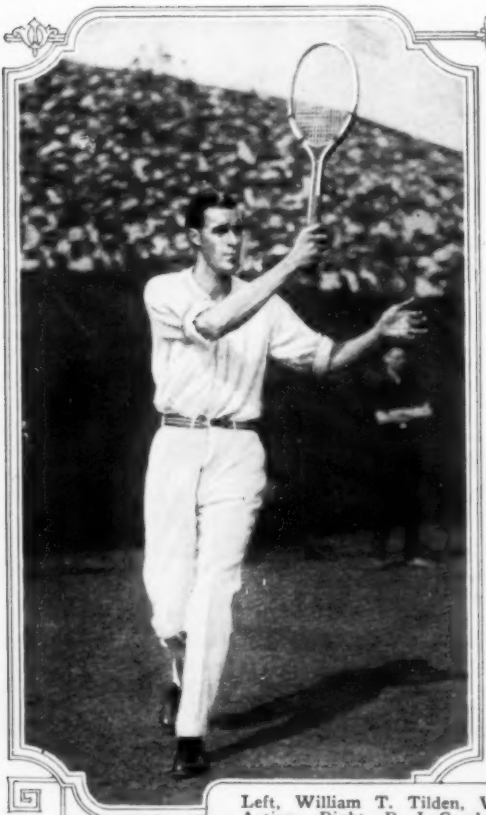
used they did not do nearly so well, though still winning first place. The same Finnish method of cutting timber was applied by them also in making discuses and skis, and produced equally remarkable results.

American ingenuity has, in the same way, done much for pole vaulting and hammer throwing. Originally pole vaulting was a purely British sport, but fell into disuse, first, because poles formed of hickory or ash were liable to snap off transversely, killing or maiming the unfortunate athlete who was impaled on the fractured spike, and, secondly, because a pole long enough to enable a man to clear twelve feet was too heavy. Americans solved both problems by making poles from the strong but extremely light "female" bamboo stalk, which may fracture but never breaks off transversely. The disadvantage of the slippery surface was counteracted by taping a handhold with adhesive tape. In the early days of hammer throwing the blacksmith's twelve-pound sledge was borrowed, but the stiff shaft was found to be a distinct handicap. Ingenious athletes then utilized cane handles, which were an improvement, but far from perfect because the vibrations were uneven and the handhold unsatisfactory. Then an American invented the modern hammer with stirrup-shaped handle, piano-wire shaft and a spherical, ball-bearing head. With the new device, the record increased from just over seventy-eight feet to a few inches less than 190 feet.

Lee Barnes, of California, Won the Olympic Pole Vault with Bamboo Pole Perfected by American Ingenuity to Eliminate Dangerous Ash Sticks

Since the London A. C. met the New York A. C. in New York in 1895, running records have steadily fallen. Three world's records were broken and one equaled in that match. The half mile was done there in one minute, fifty-five and two-fifths seconds, which was considered a wonderful performance, but an American superman, Ted Meredith, came along some years later and clipped one and a fifth seconds off that mark, and likewise set a record of forty-seven and two-fifths seconds for the quarter mile. While Meredith is a phenomenon and scientific improvement of the surface of racing tracks has also helped, yet his records have been in good part due to the improvements in training, which reduce a record breaker to perfect co-ordination of movement. Paavo Nurmi, the amazing Finn who startled the Olympic spectators at Paris last summer, has run a mile in four minutes and ten seconds and has done six miles in twenty-nine minutes, seven and four-fifths seconds. He has made a science of distance running, and, incidentally, developed himself after a manner all his own. He has little use for massage and other refinements of training, but will come in from breaking a record, rub himself down with a towel, dress and be on his way. Nurmi plans every race before he starts, decides what time he must make to win, and then carries a stop watch and checks his time at the end of every lap.

Improvement in field events has been even more marked than in running. Super-style on the track accounts for fractions of seconds, but better equipment and technique clip inches, feet and yards off the field records. Harold Osborne, the



Left, William T. Tilden, World's Tennis Champion in Action; Right, R. LeGendre, of America, Winning the Broad Jump in the Olympic Pentathlon by Setting a World's Record

F. D. Tootell, American Hammer-Throwing Champion, Won the Olympic Championship Using the American-Invented Hammer

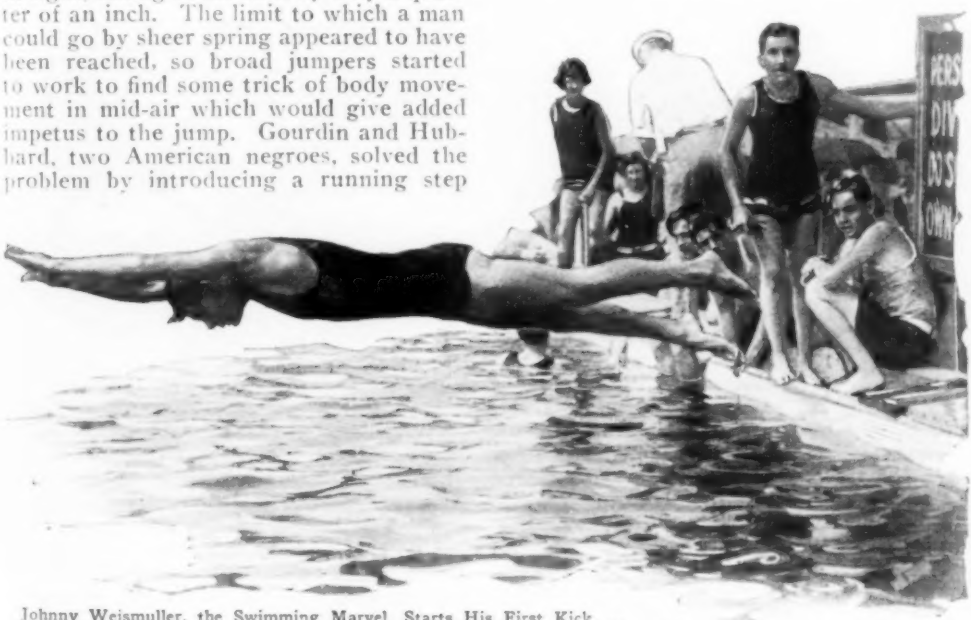
Walter Hagen Won the Metropolitan Open Championship with Scientifically Designed Clubs and Balls Plus His Own Skill

twenty-four-year-old farmer-boy schoolteacher, has cleared the bar in the highest jump ever made, at six feet eight and one-quarter inches. His record was made possible by the so-called "western roll," introduced by George Horine, which, by the way, is not a roll at all, as was proved to the international judges at the Olympic games, who watched Osborne carefully to make sure that his style was legal under the rules. In this western roll the jumper takes off at an angle of thirty-seven degrees from the line of the crossbar and gives the feet twice the momentum of the head, so that when he crosses the bar his body is parallel to it. As soon as he reaches that height, the lower, or left, arm is dropped down, the under leg is bent at the knee, while the right, or upper, leg is extended. The body gives a violent twist and describes a half revolution, which brings the jumper face downward, so that he has apparently, though not actually, rolled over and away from the bar. The head must be kept back and up during the evolution, as it is illegal to dive over the bar head first and downward.

Broad-jumping shows even greater progress than the high-jump. O. J. O'Connor, a phenomenal Irishman, attained twenty-three feet ten and three-quarter inches from a grass take-off back in the nineties. Next the late W. J. M. Newburn beat twenty-four feet, in 1898, and in 1901, O'Connor brought twenty-five feet in sight, failing to attain it by only a quarter of an inch. The limit to which a man could go by sheer spring appeared to have been reached, so broad jumpers started to work to find some trick of body movement in mid-air which would give added impetus to the jump. Gourdin and Hubbard, two American negroes, solved the problem by introducing a running step in mid-air, and both succeeded in crossing the twenty-five foot mark. Another American, LeGendre, carried the world's record on to twenty-five feet six inches, in the pentathlon at the Paris games, and did it by a backward lean of the body just prior to the mid-air step, followed by a herculean whip up from the waist in the midst of the mid-air leg movement.

Improvement in hurdling has been brought about by similar changes in technique. The straight-leg method brought fifteen seconds within sight of the 120-yard hurdlers, while a trick of raising the back knee, to bring the rear foot through quickly, has made fourteen seconds possible. Pole vaulters, by a pendulum swing, perfect timing and an upside-down arch of the body, increased their record to thirteen feet five inches, and then a young Norwegian came along with an improvement in the form of a birdlike flight after releasing the pole, and that carried him to within a fraction of an inch of fourteen feet.

The greatest field for breaking records in recent years has been among the swimmers. Many of their marks have been shattered several times a year. At the Illinois Athletic Club, where I am athletic chairman, the swimmers trained by William Bachrach, our coach, and head swimming coach of the American Olympic team, hold about ninety-five per cent of all the world's swimming records.



Johnny Weismuller, the Swimming Marvel, Starts His First Kick Here While Still in Mid-Air, a Trick That Has Helped Him Win Many Records

False Eyelashes on Adhesive Tape Worn at Will as Beauty Aid

Women who consider long, curly eyelashes beautiful are spared beading and treating their own by using sets of false

Eyelash Set Turned Sideways to Show Adhesive Strip That Holds It in Place

ones conveniently attached to a small strip of adhesive plaster that cannot be detected when it is stuck to the eyelid. They are made in various lengths and colors and are said not to interfere with the vision.

Two-Mile Dam across Nile River Will Water Parched Sudan

With the completion of the great Sennar dam now under construction across the Nile river in Sudan, a system of more than 9,500 miles of canals and channels stretching like huge veins into virtually desert lands, will be supplied with water for irrigation purposes. If the soil taken from the excavation were made into bricks, it could be built into a wall five feet high and a foot thick long enough to reach around the earth at the equator. It is estimated that when the great storage lake which will form behind the dam has been filled, more than 300,000 acres of barren ground will be brought under cultivation. The gigantic basin will hold sufficient water to supply a community the size of Greater London for two years. The construction of the retaining wall on the eastern half of the dam, developed into a feverish race against time as the period for the annual floods neared. A half-finished structure in the path of such a rush of water as takes place at this time, would have been destroyed in a few days. The required height of the wall had hardly been attained when the river began to rise. The stone used in the building of the barrier is being quarried within thirty miles of the scene.

Honey Bees Show Sirup Makers How to Improve Product

Once more scientists have gone to the bee to seek knowledge and have come away wiser, this time with a process that promises to improve the quality of sirups. From the honey gatherers, the department of agriculture has learned that a yeastlike substance the insects secrete and mix with the nectar, prevents it from souring or turning to sugar. So they plan to mix with maple, cane and other kinds of sirup what is known as invertase, a ferment made from yeast which is much like the secretion of the bee to keep their products from crystallizing so easily.

Knives and Scissors Are Sharpened by Abrasive in Holder

By placing strips of emery cloth, or other abrasive material, over a flat, steel bar holder and binding them in place with a wooden wedge under a movable brass sleeve, an inventor has produced a simple sharpener for knives, scissors, and other

Whetting Knife and Inserting Wedge under Sleeve to Hold Abrasive Strip to Bar

articles. The holder has a comfortable handle and it takes but a few seconds to change the covering.

AIR-PROPELLED BOAT STEERED BY SWINGING MOTOR

Shallow water and quantities of rubbish that made the operation of a screw-propelled boat impractical did not defeat a California rancher when he decided to use the Colorado river to haul his produce to market twenty miles from his farm. He built a flat-bottomed, barge-shaped boat, fifty-five feet long, with a beam of nine feet, and at the stern mounted a ninety-horsepower airplane motor and eight-foot propeller to drive the craft. The steering problem was surmounted by placing the engine assembly on a pivot with two pneumatic tires to support the weight of the fuselage and the fuel tank of fifty gallons' capacity. The boat is guided by simply turning the engine and propeller with a steering wheel operated by the pilot who commands an unobstructed view of the river from his seat and is protected by a glass windshield. If the barge gets stuck on a sandbar, the motor can be swung entirely around to pull the boat loose. Speed of from seven to eight miles an hour upstream against a current of six miles an hour and a rate of about twenty-five miles down the course are said to be the usual performance of the engine. The owner is planning to install a 220-horsepower motor and a larger propeller to reduce the time required to get his goods to the stores. With the smaller outfit, he can carry five tons at once on the barge, in the building of which he spent about two months.

Harnessed to Barge, Airship Motor Speeds Craft Upstream and Pilot Steers by Turning Fuselage and Propeller on Revolving Carriage

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Special Lighting Equipment Required to Film a Scene for Government Movie, "When a Man's a Miner," Designed to Illustrate Need of Caution in This Hazardous Calling

Uncle Sam as a Movie Producer

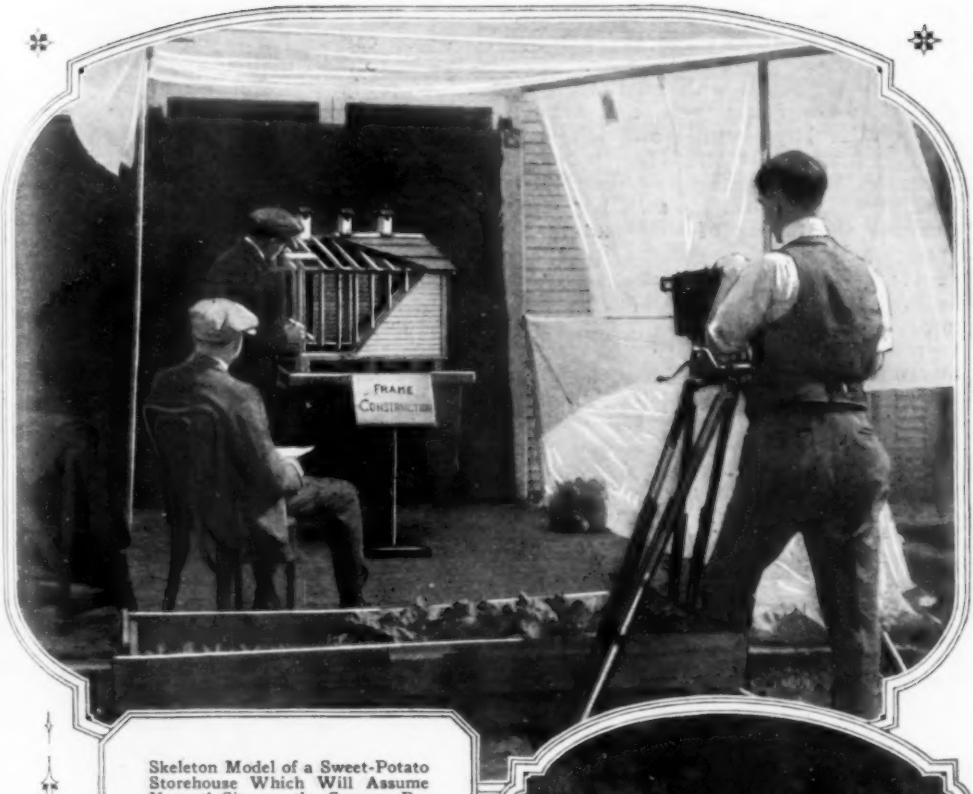
Government's Gigantic Studio Annually Turns Out Scores of Reels Portraying Educational Dramas of Safety, Health and Industry

MOVIES, with Uncle Sam as producer and a highly trained staff of directors to stage them, are now a big factor in the government's work of teaching the nation's workers the rules and facts of such everyday subjects as conservation of life, health and industrial progress.

Unlike the theatrical motion-picture makers, the government director generally has the plot already prepared for him and locations are found wherever the interests of any great number of people lie, whether in mines, farms, public parks, bird life, insect pests or many other topics which daily touch the vital social or commercial progress of the nation. Both villains and heroes are furnished by nature in a number of the dramas, and tragedy stalks in the form of destructive pests and diseases of plant life as well as in hazard and danger which are always present wherever men and machinery combat nature to secure needed minerals and vegetation to supply busy marts and factories.

A great amount of film is also taken up in carefully constructed studies of plant life. Attractive picture stories are built about the doings and habits of small animals, and the pest varieties are all vividly shown in their natural haunts. Their good points are emphasized together with their evil acts against the safety and security of mankind, and as a general rule the best methods of combating or destroying them are detailed.

So widely popular has this manner of educational work become that there is hardly a government department that does not make use of the motion picture for spreading progressive propaganda among those they desire to aid or recruit in the various movements for public good.

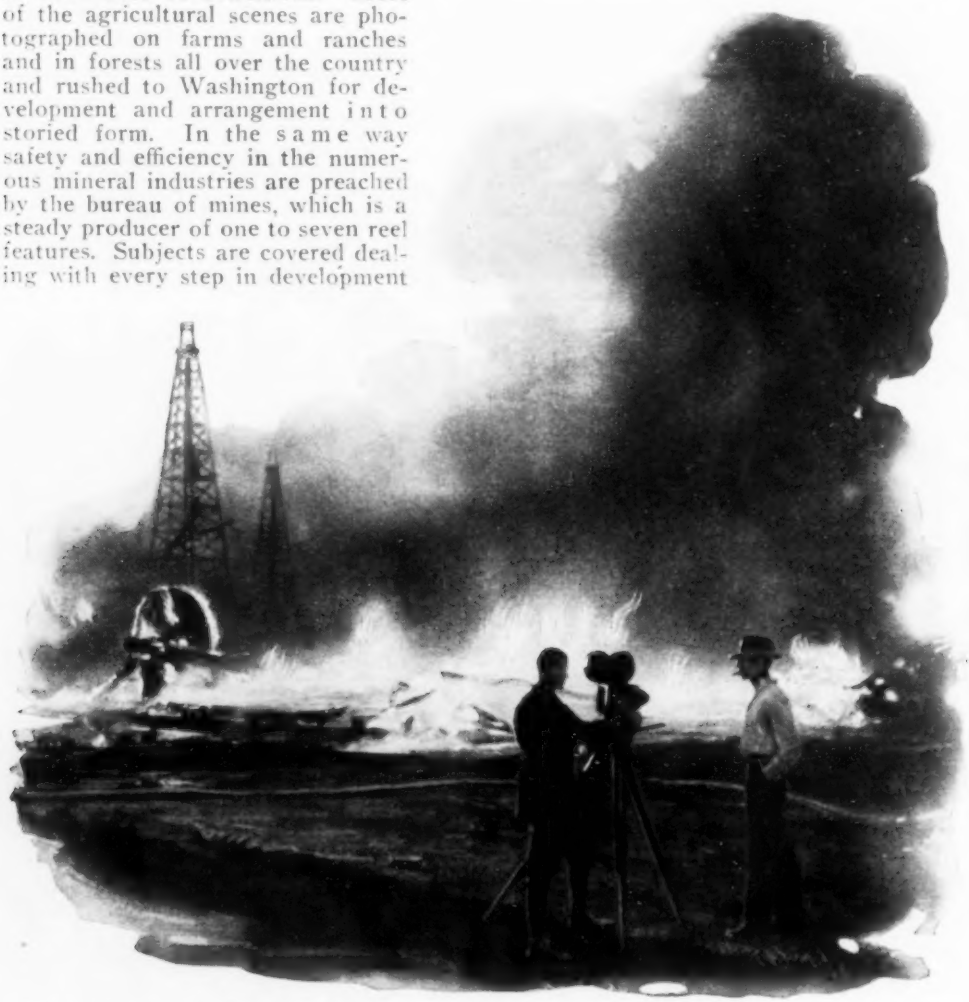


Skeleton Model of a Sweet-Potato Storehouse Which Will Assume Natural Size on the Screen; Below, Bureau of Mines Movie Men Shooting Drilling Operation 3,700 Feet under Ground

Taking Close-Up of Miniature Farm Scene Composed of Grass and Twigs with Painting for Background

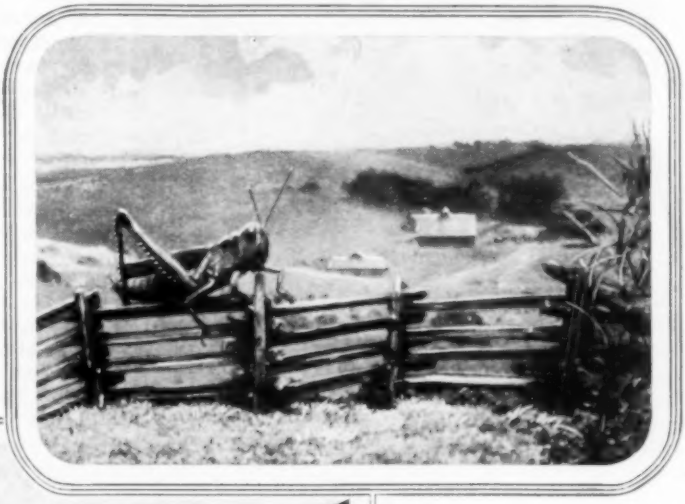
It is estimated that the department-of-agriculture pictures alone are witnessed by 25,000,000 people each year. These films are produced with all the art that marks the dramatic reels, and are prepared in a large studio and laboratory equipped with facilities for projecting them for test, printing and distributing. The department has its own high-speed cameras for taking of slow-motion pictures, and special apparatus for microscopic work with seeds, plants and insects. In conjunction with the main studio is a complete animated cartoon department where details that cannot be provided in any other way are added to the pictures to make them even clearer than the most carefully operated camera can take under the best of conditions. Most of the agricultural scenes are photographed on farms and ranches and in forests all over the country and rushed to Washington for development and arrangement into storied form. In the same way safety and efficiency in the numerous mineral industries are preached by the bureau of mines, which is a steady producer of one to seven reel features. Subjects are covered dealing with every step in development of minerals from their natural formation which can be portrayed by special processes, to their mining and ultimate manufacture into useful materials. Though many of the mining pictures have cost large sums of money, their completion has in several cases been financed by large concerns co-operating with the government in the work of education along these lines. To add reality to a film showing some interesting operations in the oil fields, a big derrick costing thousands of dollars was purposely burned down by the firm which owned it, to create a scene teaching a fire-prevention lesson in this particular industry.

Actors are engaged from all walks of life and rarely is any salary demanded for



Fire Prevention in the Oil Fields Is Aided by Spectacular Films Made by Government Bureau Which Provide All the Thrills and Romance of the Staged Affairs

their services, since the bureaus draw on the workers and officials of the different concerns for their casts of characters. If a number of people are needed, advertisements rarely fail to draw more than enough volunteers from among whom the necessary talent can be selected. One seven-reel picture telling the story of oil from early biblical days to the present, may require many people for the proper action of the piece and these might be secured within a short time from the neighborhoods in which the scenes are staged without any more expense than the cost of a "want ad." There seems to be no difficulty in procuring sufficient volunteers for roles in such productions. Each of the bureaus has its own fields of production from which it does not depart. Health and sanitation films are made by the public health service. The bureau of reclamation shows elaborate pictures dealing with the gigantic irrigation systems of the west, while child welfare and women in industry are aided by the department of labor, which offers attractive screen stories furthering the cause of those whose callings are under the supervision of that branch of the government.



Above, How Grasshopper and Miniature Farm Emphasize Insect Peril; Below, Transporting Movie Apparatus over Arizona Mountains

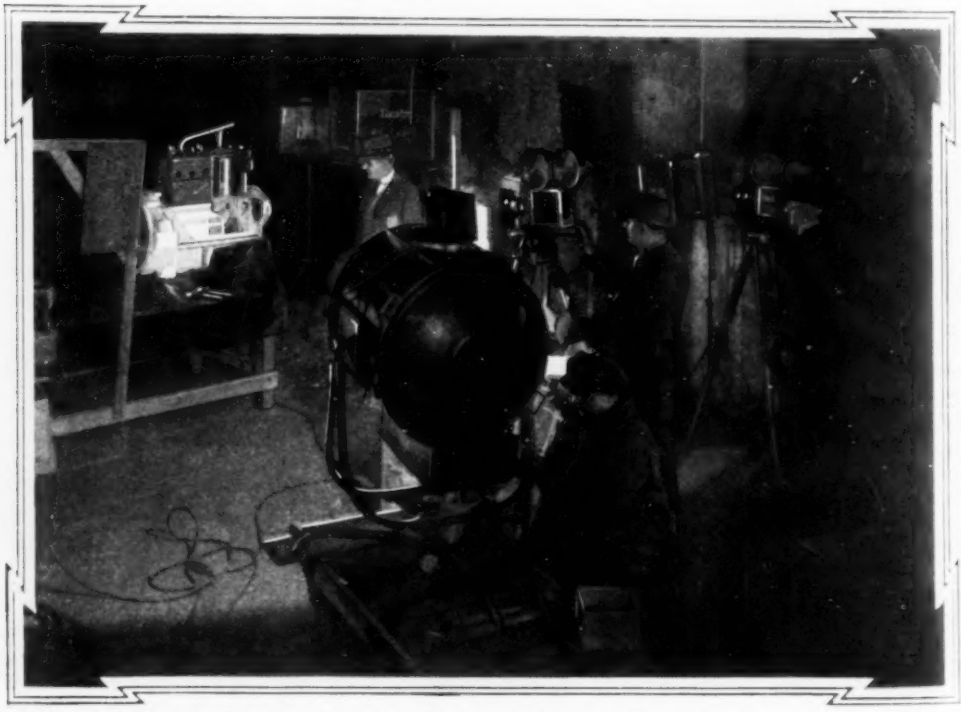
As the gorgeous national parks are set aside as playgrounds for the nation's people, the department which cares for these lands and distributes information concerning them, keeps a constant motion-picture service in operation to photograph the interesting things in connection with the resorts, which helps to maintain an almost year-round stream of tourists traveling to the seasonable points for recreation and sight-seeing. Even the army and navy have their propaganda films which are used in aiding the recruiting services to explain to prospective "rookies" the attractions and advantages of enlistment in these organizations. Entire stories of sea cruises or life in the land arms are arranged in a form which leaves little or nothing to the imagination. Such reels are displayed also for the benefit of patriotic societies and like organizations of citizens in all parts of the country. From the largest battleship designed to protect the nation to the smallest insect which annoys and impedes the farmer or forester, the range of the movie camera reveals in actual scenes the operations of the corps of Uncle Sam's motion-picture producers.

As in the dramatic studio, miniature settings are often employed. To illustrate graphically the perils of flour-dust explosions in grain mills and storage elevators, a tiny replica of a large grain elevator was built and an explosion imitated by blowing flour out the doors and windows with

Filming the Story of Good Roads by Demonstrating the Qualities of Various Materials with Panels of Paving Surfaces

a bellows. The camera was set in a close-up position so that the finished picture presented a realistic appearance with the effect of a genuine occurrence. Sometimes elaborate outdoor farm scenes are set up and photographed in the studios at Washington to illustrate some particular condition existing in areas thousands of miles away. For these, miniature landscapes are constructed of grass and twigs, crossed by a network of rail fences made of toothpicks. Against this setting, an ordinary grasshopper looms as large as a dragon, but it serves to show the danger in allowing such pests to roam unopposed over a farming district. Germination and growth of plants are ingeniously photographed by a special camera devised by a member of the government's force. This device is operated by clockwork and takes pictures at determined intervals. Though the exposures may be made weeks apart, when the final reel is shown the entire movement seems to take but a few minutes. In this manner the development of flowers and forage plants can be shown gracefully unfolding from the tiny seed after it bursts in the soil.

Spectacles in the genuine are furnished by the forest-fire fighters who become the principals in the tragedies of the timberlands, filmed as lessons to those working and traveling there. Airplanes are often used to illustrate the precautions taken by the national forestry division for the protection of life and property.



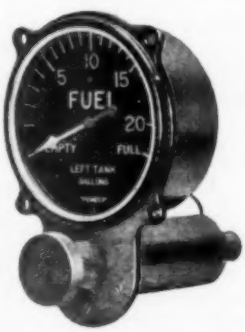
Where a Gasoline Engine Becomes the Subject of a Movie; the Motor Was Actually Sliced in Two to Disclose Construction and Operations of Its Different Parts

Incubators for Raising Oysters to Provide Constant Supply

Natural oyster beds in Chesapeake bay and elsewhere cannot always be depended upon for sufficient harvests because of water pollution, storms and other causes. An incubating process, developed by the bureau of fisheries, is seen as a successful way around these uncertainties. The bivalves are induced to spawn in sunlit tanks. As soon as the eggs have become swimming larvae—a change that takes only six or eight hours—they are removed to rearing basins. By the time they are two days old, they have developed a pair of tiny shells. Then the attendants take ordinary egg-crate partitions, dip them in hot paraffin, cover them with sand and put the sections in the tanks where the baby oysters settle upon them. Flowerpots are sometimes used for this purpose. When the collectors are covered with "spat," as the young are called, they are dropped overboard into the sea at suitable spots, and the little oysters begin to shift for themselves. They grow rapidly, under favorable conditions attaining a length of more than an inch in two months, three inches in a year, and in two years, they may be ready for the half-shell trade.

Plane's Fuel Told by Air in Tank on Dial at Pilot's Seat

The exact amount of fuel in the tank of an airplane can be shown on the instrument board by a gauge dial which operates by the weight of the gasoline on an air cell in the container. It is claimed that with this device, aviators on flights can be kept constantly informed of the condition of their fuel supplies, making the carrying of excess material and forced landings for lack of gas unnecessary. When temperature and altitude cause loss of air in the tank cell, a single stroke of a small pump provided for the purpose replaces the amount, assuring the accuracy of the measurements. The gauge is designed also to indicate the volume of fuel in reservoirs of gasoline-driven vehicles and for similar use on storage tanks.



Works of Watch Run Two-Foot Clock That Folds into Small Box

So finely balanced that it is operated by the works taken from an ordinary watch, a clock with a dial two feet in diameter has been made to fold up for storing in a box, ten inches long. The entire mechanism of the timepiece weighs only a pound and is said to keep perfect time. To permit easy winding, the stem of the watch has been extended on a long shaft and is also used for setting the hands. The dial is of sheet metal and the large figures are stenciled in the face. The clock may be hung on a wall or installed in a window.

© U. & U.

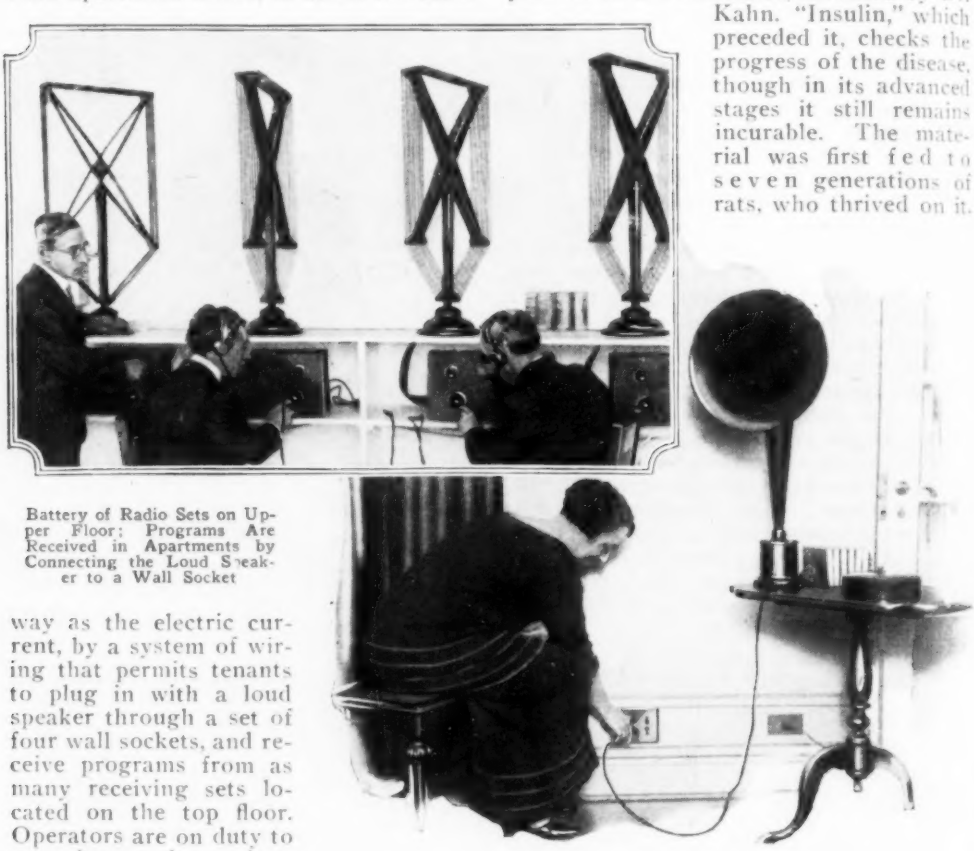
Metal Clock, Run by Works of Watch, Which Can Be Folded in Small Box

Electric Dredges That Dig for Gold Increase Alaskan Yields

In the footsteps of the prospectors with their picks and pans have come big electric dredges for the gold hunt in Alaskan fields. These powerful outfits can dig down sixty feet deep and scoop out as much as 200,000 cubic yards of material in a month. All of this is sluiced and washed within the dredge itself and nearly every flake of gold extracted. In 1922, dredging accounted for sixty-nine per cent of the volume of placer gold mined in this country, the total from dredging operations in the period from 1896 to 1922 being placed at $180,800,000.

Apartment House Wired for Radio through Wall Plugs in Rooms

Radio is distributed through a New York apartment house, in about the same way as the electric current, by a system of wiring that permits tenants to plug in with a loud speaker through a set of four wall sockets, and receive programs from as many receiving sets located on the top floor. Operators are on duty to tune in on the various stations and fill special requests from the listeners. A transfer of the horn wire brings any one of four programs to the tenant, and families who so desire may have a loud speaker for each socket. As an added attraction, the arrangement, like up-to-date plumbing and the latest electrical conveniences, while increasing the desirability of the rooms from the renter's standpoint, also eliminates disfiguring the outside of the building with an array of aerials, the central receiving sets all employing loops.



Battery of Radio Sets on Upper Floor; Programs Are Received in Apartments by Connecting the Loud Speaker to a Wall Socket

Artificial Fat Is Newest Weapon to Fight Diabetes

"Intarvin," an artificial fat made from ordinary beef tallow or steer fat, has been added to the new weapons for the relief of sufferers from diabetes, according to a report to the American Society for the Advancement of Science by Doctors Max Kahn, William J. Geis and Hattie J. Heft, who have been experimenting for two years with the substance, invented by Dr. Kahn. "Insulin," which preceded it, checks the progress of the disease, though in its advanced stages it still remains incurable. The material was first fed to seven generations of rats, who thrived on it, and then tried out on diabetic patients. It was found that they gained in weight and lost all sense of undue hunger, while the usual doses of insulin could be reduced.

Portable Cleaner for Old Brick Cuts Cost of Removing Mortar

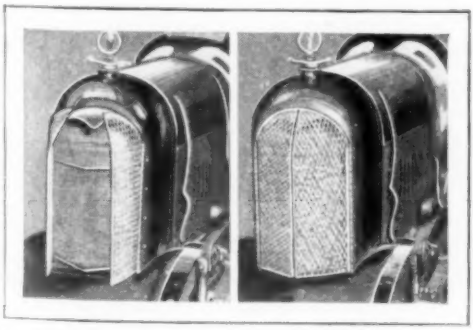
With a portable outfit that removes the mortar from secondhand brick at the rate of 24,000 or more a day, a great saving over hand methods is effected. Two men are required to operate the machine, which is run by a three-horsepower gasoline engine. As the bricks pass into the cleaner, they are struck successive blows by a hammer that knocks off all the mortar. A conveyor carries the brick to a truck, or they may be piled on the ground. The old mortar falls into a metal trough leading to a waste receptacle.

Killing of Flowers by Gas Leads to Valuable Medical Discovery

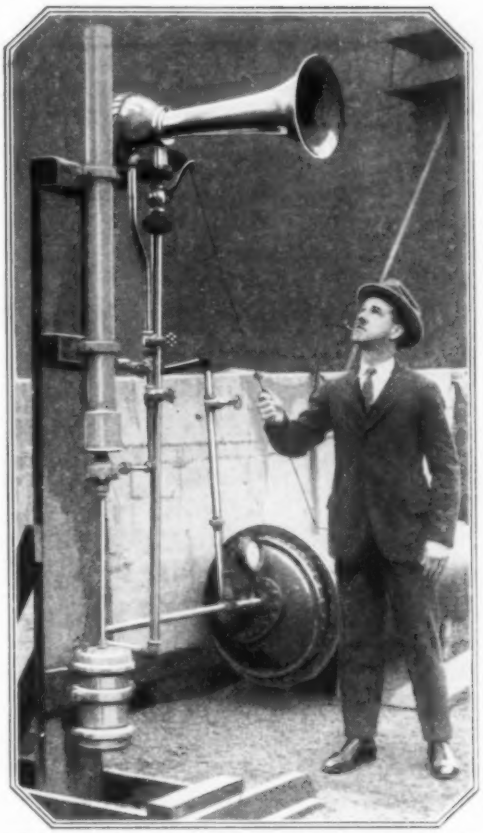
Discovery of ethylene, a valuable and widely used anesthetic, was due to the investigation of the death of hothouse flowers caused by illuminating gas, according to Dr. William Crocker of an eastern plant-research institute. Approached by a florist seeking a reason for the sudden killing off of greenhouse carnations, he said, investigation of the air surrounding the growths was made. The presence of a small quantity of gas such as is used for heating and lighting was discovered. Close examination of this showed part of it to be ethylene. Under the influence of a slight mixture of this matter, the flower buds died and fully developed blossoms would close. Air containing a minute percentage of the gas is said to put blooming carnations to "sleep" in about twelve hours without killing them. Further experiments showed that the gas was effective in producing the yellow colors on citrus fruits, when green. Previous to this discovery kerosene stoves were employed in fruit-curing houses to mature the products.

Radiator Screen for Racing Autos Prevents Engine Overheating

Scraps of paper, lodging against the radiators of speeding racers in automobile contests, have compelled more than one driver to abandon the course, due to an overheated engine. The refuse cut off the circulation that helped keep the water's temperature down. To prevent mishaps of this kind, a veteran pilot has invented a screen which fits over the radiator front and can be opened by means of a lever from the driver's seat, throwing the papers to one side. The screen is put back by a reverse move of the lever.



Radiator Screen Open and Closed to Show How Papers Are Caught and Removed



When Whistle Valve Is Pulled, White Cloud of Smoke Appears as Substitute for Steam

Visible Air Whistle on Motorboats Reduces Shipping Hazards

Although some ships driven by Diesel engines have found a substitute for the steam whistle in compressed-air apparatus, this leaves no warning cloud of vapor, a great aid in crowded waters, and installation of steam boilers just to supply the whistle has been exceedingly expensive. To remedy these difficulties, an air signal has been combined with a tank of a liquid smoke-producing preparation in such a way that, when a blast is blown, a cloud of dense white vapor mixes with the air, making a signal of even greater visibility than ordinary steam. One tankful of the preparation is said to last for several months of average operation.

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Dummy at Auto-Filling Station Keeps Hose off Ground

To keep the air and water hose from being left on the ground and exposed to

White-Clad Dummy Figure That Supports Air and Water Hose at Filling Station

wear and damage, the proprietor of a California filling station fashioned a holder in the form of a dummy attendant, clad in white and wearing a cap, and placed it at a signpost. The shoulder of the figure was fixed to support the lines when customers were through with them and served to remind the users to put the hose back in its proper place.

Value of Nation's Chicken Output Quarter of a Billion Dollars

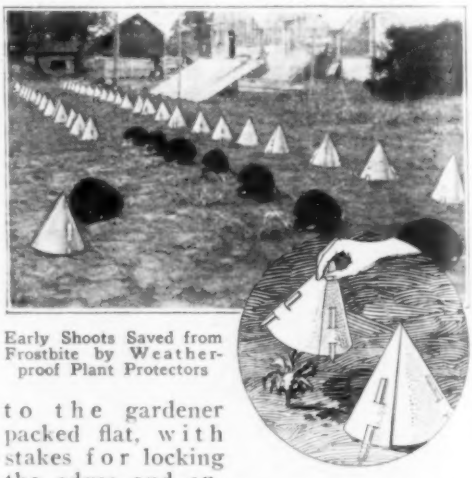
There were approximately 450,000,000 chickens on the farms of the United States in 1924 with a total value of $350,000,000, according to the department of agriculture. The egg production was placed at $600,000,000 for the year. This form of produce, like others, has shared in the rise of prices, advancing from an average of 10.7 cents per pound in 1913 to 44.2 cents at the beginning of 1923. The crop is chiefly produced in the upper Mississippi valley where most of the grain on which the fowls are fed is grown. Poultry has become an important factor in foreign commerce in the last twelve years, exports for the period totaling more than $100,000,000, while imports of eggs in various forms, especially from China, amounted to about $40,000,000 for the same time.

Queer Cargoes Carried by Ships Include Walrus Whiskers

Besides the familiar articles of merchandise arriving on steamers daily, many strange things are to be found among the cargoes. For instance, thirteen tons of dried flies were carried by an English liner arriving at Plymouth from Mexico. They were to be used in making paint. Similar consignments are brought from Brazil for the manufacture of food for poultry. Cases of walrus whiskers are sometimes received, to be turned into toothpicks, and frog skins are imported from India for the bookbinders who find that a delicate leather can be made from them, easy to work and taking soft colors in dyeing. "Twenty-five Tasmanian devils" were included in a shipment of birds and beasts from Australia and the island south. The "devils," savage burrowing creatures though they are, were considered less deadly than a case of "diseases," cultures of malaria, blackwater and other fevers common to the tropics.

Paper Cones on Plants Repel Frost and Are Weatherproof

To protect plants from frost, a weatherproof paper cone has been made. It comes



Early Shoots Saved from Frostbite by Weatherproof Plant Protectors

to the gardener packed flat, with stakes for locking the edges and anchoring it to the ground. The cones also may be used as sun or windbreaks by tilting them sufficiently for proper ventilation.

Empty Shell of What Was Once an Imposing Bank, the Abandoned "Ghost" City's Center of Finance during a Brief Heyday of Industrial Clamor and Commercial Boom

Ghost Towns of the West

Abandoned Cities, Once Thriving Communities of Eager Toilers, Mark Sites of Mining Tracts Which Failed Hopeful Owners

OF all the "ghost towns" in the west there is one that stands out above all, not only because it once had such a large population, but also because its business district was unusually well built up for a mining community. And when one considers the town was built on nothing more substantial than the most speculative of stocks, it is all the more remarkable that it ever existed at all.

This town, now but a ghost in the desert, is Rhyolite, Nevada, which at the height of its boom had a resident population of six thousand, with transients averaging five thousand, which kept the town well up in the ten-thousand class for some time. And so well established did it seem to be that two railroads entered Rhyolite, one the Las Vegas and Tonopah, covering the 115 miles to Las Vegas on the southeast, while the Goldfield-Bullfrog came down from the north. The Tonopah and Tidewater of today, which operates between Ludlow, California and Goldfield, uses the tracks of the Goldfield-Bullfrog above Beatty, Nevada, which is but four miles from Rhyolite.

Back in 1905, before the railroads had entered, Rhyolite was a booming camp even though everything had to be hauled in wagons from Las Vegas, with quite a bit of competition between teaming companies for the rich harvest of dollars—and dollars were quite plentiful and freely spent in the boom days. In 1906, the Las Vegas and Tonopah entered, and after that Rhyolite took on a most substantial appearance, two large three-story buildings of reinforced concrete being constructed and later a fine eight-room school building with metal tile roof. The Las Vegas and Tonopah also put up a passenger station which in architecture, material and workmanship would do credit to many an enterprising community of twenty-five thousand—but there it stands, vacant, with all interior woodwork torn out and no rails leading to it. The line was torn up in 1917.

Down in the center of the town, along the main street there now stand a few deserted buildings in all stages of decay. In the whole town there are but a very few buildings now intact, and the reason for their existence is that a few former residents are still paying taxes on their property, though in the last year or two, several have given up all hope of Rhyolite ever being anything but a ghost and have torn down their houses. In the case of

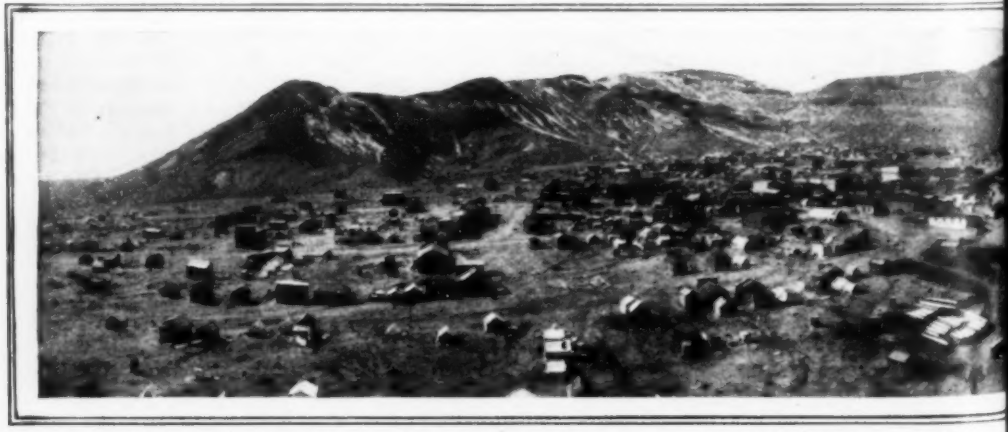
House of Bottles in Forgotten Rhyolite, Grim Reminder of Care-Free Confidence That Kept a Constant Flow of Money Circulating through Stores and Shops Now Marked by Naked Walls

the bank building, it was stripped of all woodwork, including floors, last year, and now it is the turn of the Overbury building, the other three-story edifice.

In the residence section of Rhyolite can still be seen the most perfect specimen of bottle house to be found in the west, a very elaborate affair considering the building material used. The walls are made of empty glass bottles laid in cement with their bases out, making an interesting monument to the roistering days of the wide-open mining town.

With authentic printed information unavailable, the stories of those who lived in Rhyolite at one time or another reveal that there never was any particular reason for such a large community as Rhyolite once was except that it was a stock proposition. True, the Bullfrog mining district is known to be very highly mineralized, and produced some wonderful ore in small quantities, but not one mine was successful, most of them being total losses, for the simple reason that the rich lead which started the stampede, was badly faulted.

So it was confidence, or hope, that bolstered Rhyolite up, though from 1907 the population rapidly dwindled until in 1922 it had but one permanent resident, J. D. Lorraine, an aged Frenchman, ninety-two years of age, who died early in 1923, thus leaving the town without a single inhabi-



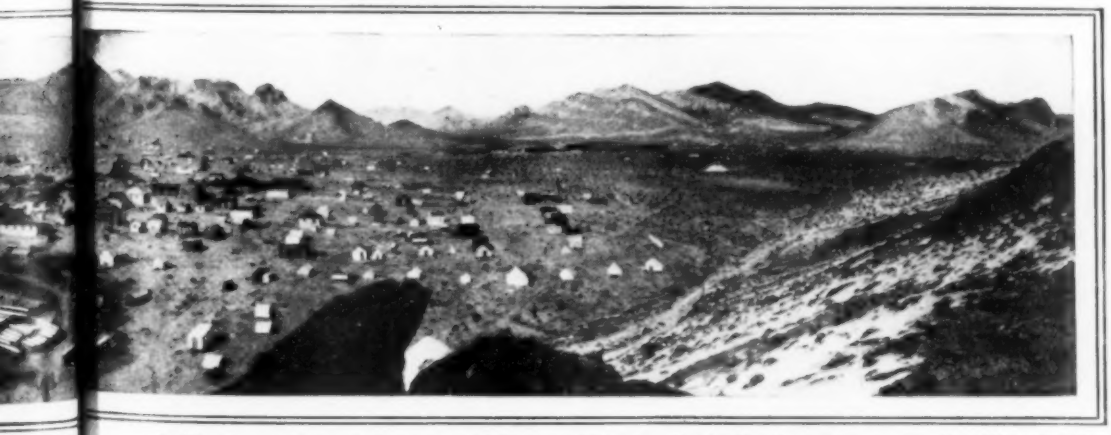
In 1905, This City of the West Lived on Hope, While Its Tireless Workers Feverishly Pierced the Rocks Below for Coveted Minerals That Promised Wealth and Success

Left to the Whims of Time and Weather, the Railroad Station That Welcomed the Hopeful Stranger Registers a Mute Record of Blasted Ambitions and Wrecked Fortunes

tant. In 1922, large numbers of buildings were intact and the aged resident, despite the weight of his years, was still confident that some day some prospector would locate the lost lead, and once again Rhyolite would teem with excitement.

Now, in 1925, the rapid decay is only too evident, much timber being salvaged and the main business street nothing but a memory suggesting, in many ways, a war-born town of 1918. With the exception of the bottle house, which is being maintained as a curiosity, and the station, which is so solidly built, Rhyolite will soon be nothing but a forgotten ruin in a great graveyard of mushroom cities that dot the west. Such is the story of scores of other once promising towns that rose over night on the sites of mythical mineral lodes, only to fade away under tangles of weeds and dissolve into masses of debris and tumbledown shacks when leads were lost or petered out.

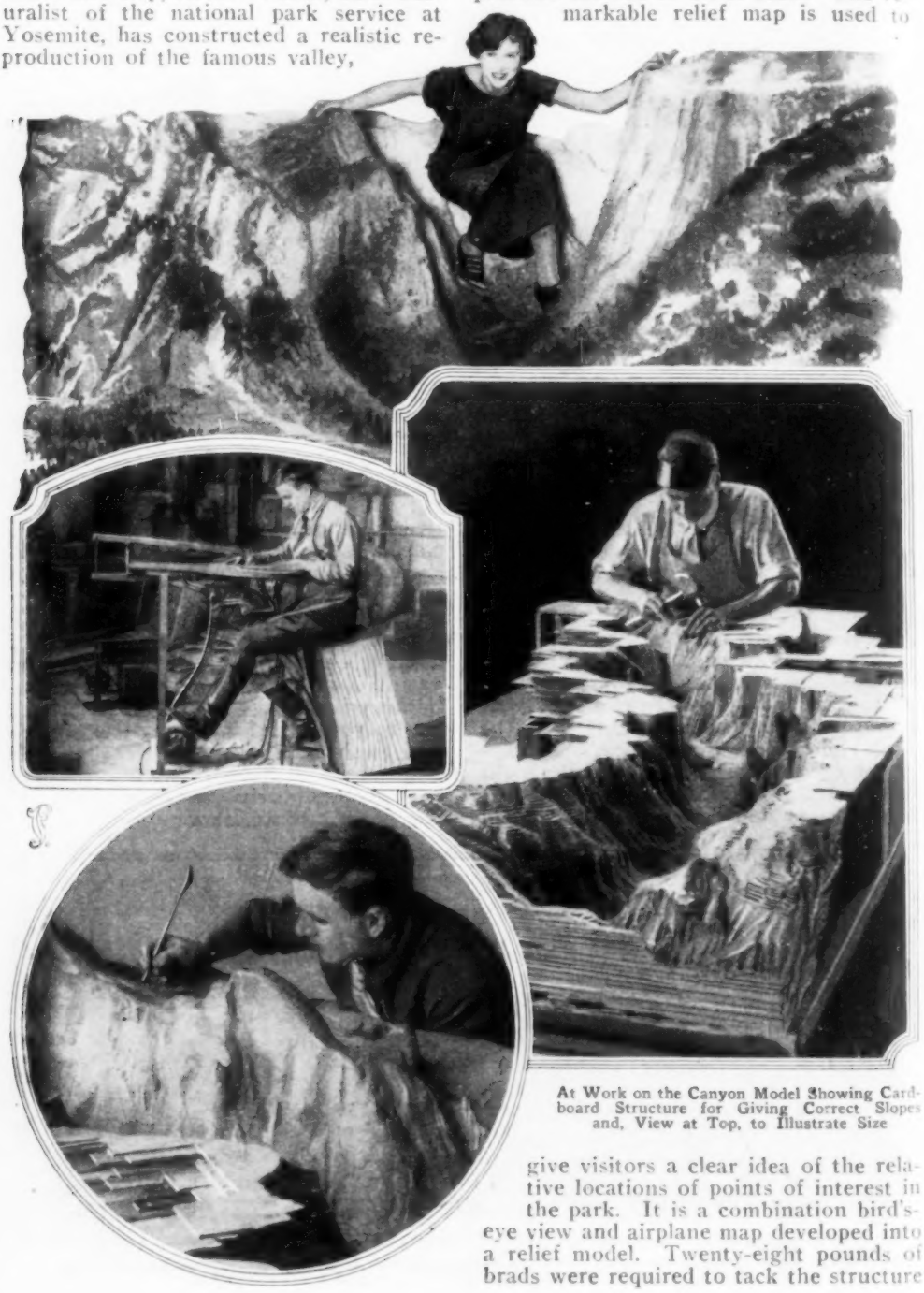
Up and down the whole range of the mining country are still to be seen traces of trails and highways once choked by frenzied gold and silver seekers in days long passed. The fever and excitement following a "find" always brought a motley army of traders, toilers, gamblers and adventurers to the scene, eager to risk their fortunes in the hope of emerging from the feverish contest in possession of great wealth. Now only mute, wind-swept ruins, blackened with age, remain to testify to the enterprises and industry of those who trudged the hills and sun-scorched deserts in the wake of hidden treasure, tempted by thoughts of early rewards in return for long hours of hard labor.



At First but a Scattered Community of Tents and Wooden Shacks Nestling under Surrounding Hills, Rapid Progress Replaced Ramshackles with Architecture of Brick and Stone

YOSEMITE MODELED IN CARDBOARD AND CLAY

With a jig saw, modeling tools made from the ivory of a mastodon, bits of cardboard and clay, Ansel F. Hall, chief naturalist of the national park service at Yosemite, has constructed a realistic reproduction of the famous valley, ten by four and a half feet in size and showing practically every rise and depression molded to exact scale. The remarkable relief map is used to



At Work on the Canyon Model Showing Cardboard Structure for Giving Correct Slopes and, View at Top, to Illustrate Size

give visitors a clear idea of the relative locations of points of interest in the park. It is a combination bird's-eye view and airplane map developed into a relief model. Twenty-eight pounds of brads were required to tack the structure

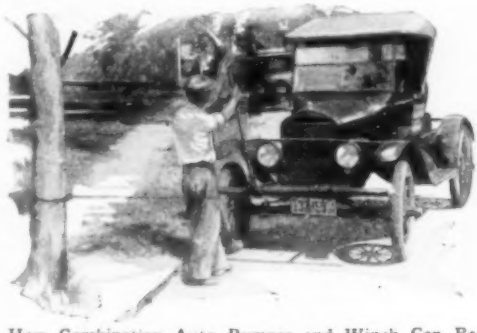
together, and 31,500 square feet of cardboard, cut up into hundreds of pieces, were used in making the foundation for the clay. The naturalist copied his model from contour and relief maps prepared by the government. Each layer of cardboard was cut to one-eighth of an inch in thickness and represented an actual rise of fifty feet in the ground. The strips were cut according to the contours shown on the surveyor's maps and spaced in like manner. The result was a series of cardboard "stairsteps" upon which the clay was spread and molded. For some of the finer details, actual photographs were used.

Sleeper-Hammock Idea Is Traced to Indian Papoose Cases

The mesh hammocks for wearing apparel seen in berths of Pullman sleeping cars are said to have been modeled from similar woven bags used by Ute Indian mothers to carry babies. It is claimed the inventor of the sleeper, while traveling in the west in 1878, saw many squaws with wool network cases in which the infants were comfortably transported. This material had been substituted for buckskin which had become scarce in certain sections of the country. A few months later, similar hammocklike bags were installed in the railroad coaches.

Automobile Bumper Fitted as Winch for Relieving Stalled Car

Designed especially for districts where roads are bad, an automobile bumper equipped with a ratchet gear can be quickly changed into a winch for hauling the car out of mud holes and ditches. Without outside help, one man can easily handle the device and produce sufficient pull to move a heavy machine. A lever which fits the ratchet is carried inside the bumper beam, which also holds the rope, neatly reeled around the shaft. In case the car becomes fast in the mud, the cable can be thrown about a tree or post, and by winding it up on the bumper drag the vehicle to safety in a few minutes.



How Combination Auto Bumper and Winch Can Be Utilized to Relieve a Stalled Car

Writer Pens Six Hundred Words on Back of Postage Stamp

Without the aid of magnifying glass and using a fine steel pen such as is employed by engravers, an eastern man has written 600 words in ink on the back of a postage stamp. He claims to have surpassed a previous record of an Italian penman who inscribed 11,000 words on a postal card, as the latter feat represents 575 words to the square inch, assuming that the card was of the ordinary size, while the postage-stamp feat necessitated copying the material, two of Lincoln's speeches, at the rate of 734 words to the square inch.

Writer Holding Frame in Which He Has Mounted Stamp Inscribed with 600 Words

Radio Tubes to Melt Steel

Masses of steel can be melted to white-hot liquid with the aid of tubes such as are used in wireless outfits, according to Dr. C. H. Desch, of the metallurgy university at Sheffield, Eng. Mills there are reported to be installing trial furnaces for testing the efficiency of the tubes in the manufacture of nickel alloys. It is planned to pass alternating current of 200 volts through them at extremely high frequency and then into the metal, which becomes hotter than the crucible containing it.

Cross-Word Pattern Handkerchief Designed for Puzzle Fans

One of the latest novelties arising from the cross-word-puzzle fad is a handkerchief bearing a checkerboard pattern in the center, suggesting the arrangement of horizontal and vertical squares that perplex the word seekers. The large block of squares is inclosed in a border that further develops the puzzle pattern.

Checkerboard - Pattern Handkerchief That Reminds Cross-Word Puzzle Addicts of Their Favorite Sport

Tool Box Hidden in Step of Auto Locked by Car Door

To save trouble of displacing the seats of automobiles to reach tools needed in an emergency and to permit storage space for extra materials, a chest is now provided which can be placed under the running board. When the car door is opened, a safety lock on the cover of the container is released, allowing a portion of the step to be raised and the box pulled out. The door can be closed again only after the tool holder has been properly replaced. The box is constructed to fit close under the tread board, so that the step forms a dust and waterproof cover.

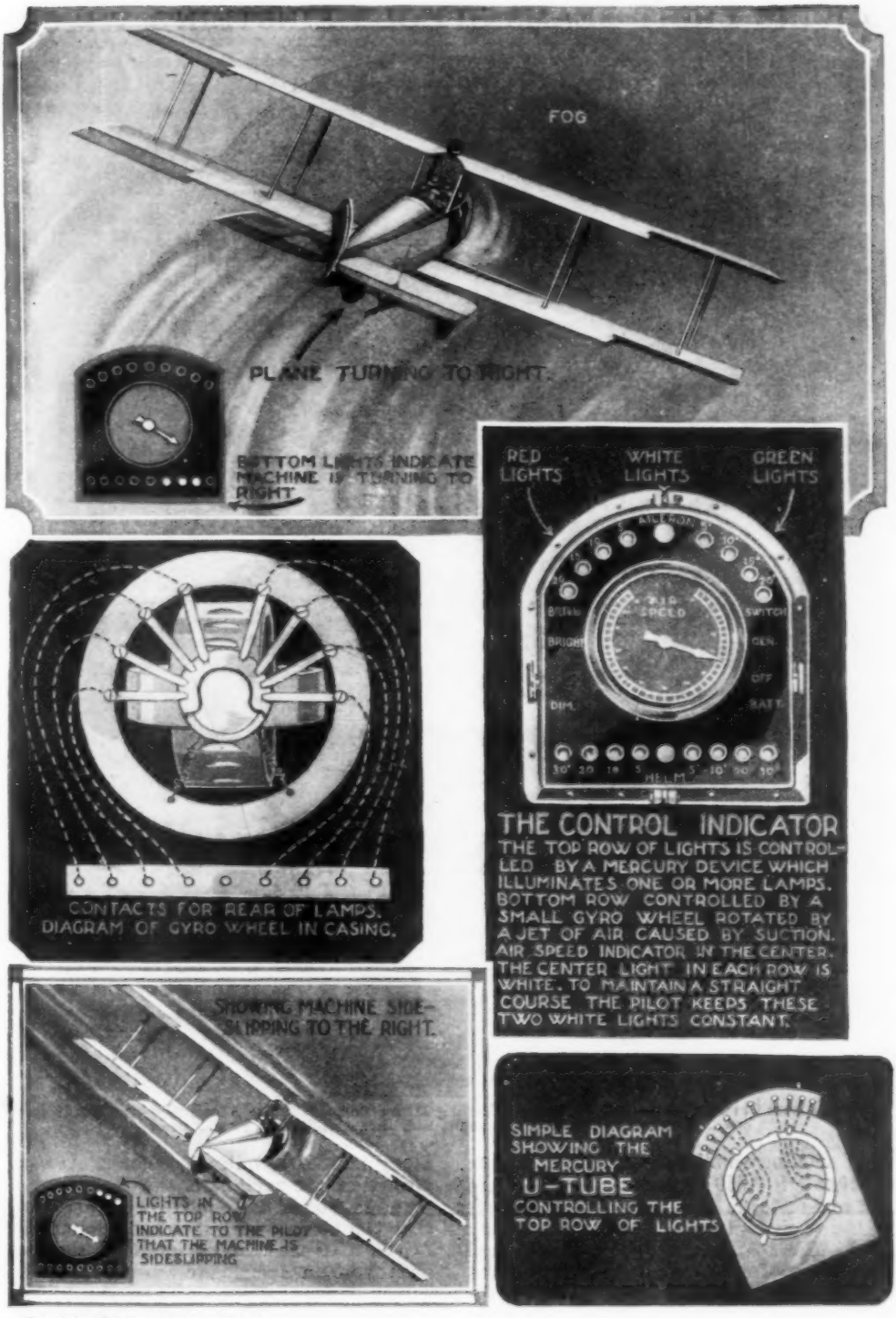
Automobile Tool Box Installed under Step Which Locks with Closing of Car Door

Organ of Balance to Guide Airmen Resembles That of Human Ear

Risks of aviators losing their way in heavy fogs and dense darkness may be greatly reduced by aid of a control indicator which detects side slips and false turns of airplanes in flight. Fitted to the instrument board of the machine, the device instantly reveals by means of series of lights the slightest swerve from the straight course. This organ of balance is said to resemble the operation of the balance nerve of the human ear, which, though it immediately warns of any deflection of the body from the perpendicular, must have the assistance of the eyes for the person to estimate the angle of change. It is claimed that where no fixed object is available to the sight, such alterations from a determined course cannot be measured. To provide an indicating method, the control register has two rows of tiny lights which flash up to show the amount of bank or turn an airplane takes. Should the nose of the machine tip in either direction, a speed dial tells whether the rate of travel is increased or lessened, thus indicating upward or downward movement and guiding the pilot's use of elevating controls. The side-slip lamps are governed by a mercury tube and a gyroscope controls those to indicate turn. While the ship is flying a true course and maintaining proper balance, two white lights burn continuously, switching off immediately when the craft leaves the straight path; then colored lamps light up, from the center outward, to whichever side the plane may lean or swerve.

Yearly Cost of Smoke in Big Cities Nearly Eight Dollars per Person

According to the bureau of mines, smoke causes an annual loss of about $7.66 for each man, woman and child in the larger industrial cities of this country. Philadelphia's yearly smoke bill is placed at $16,852,000, and this loss, according to experts, could be prevented by the installation of modern stoking devices.


FOG
PLANE TURNING TO RIGHT.
BOTTOM LIGHTS INDICATE MACHINE IS TURNING TO RIGHT
RED LIGHTS
WHITE LIGHTS
GREEN LIGHTS
AIR SPEED
SWITCH
GEN.
OFF
BATT.
BRIGHT
DIM.
HELM
CONTACTS FOR REAR OF LAMPS.
DIAGRAM OF GYRO WHEEL IN CASING.
THE CONTROL INDICATOR
THE TOP ROW OF LIGHTS IS CONTROLLED BY A MERCURY DEVICE WHICH ILLUMINATES ONE OR MORE LAMPS. BOTTOM ROW CONTROLLED BY A SMALL GYRO WHEEL ROTATED BY A JET OF AIR CAUSED BY SUCTION. AIR SPEED INDICATOR IN THE CENTER. THE CENTER LIGHT IN EACH ROW IS WHITE. TO MAINTAIN A STRAIGHT COURSE THE PILOT KEEPS THESE TWO WHITE LIGHTS CONSTANT.
SHOWING MACHINE SIDE-SLIPPING TO THE RIGHT.
LIGHTS IN THE TOP ROW INDICATE TO THE PILOT THAT THE MACHINE IS SIDESLIPPING
SIMPLE DIAGRAM SHOWING THE MERCURY U-TUBE CONTROLLING THE TOP ROW OF LIGHTS

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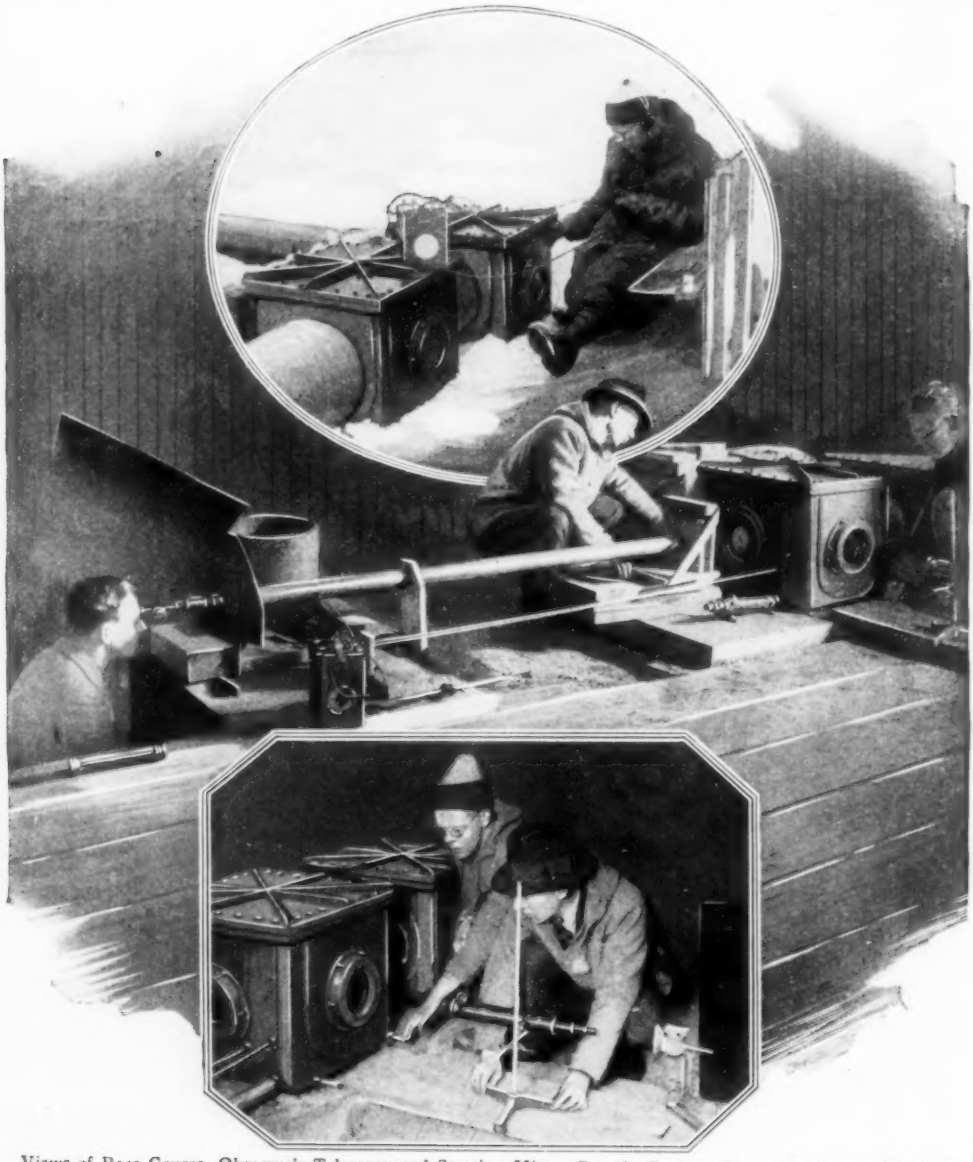
Explanatory Drawing of the Reid Control Indicator Which Resembles the Human Organ of Balance and Aids Airplane Pilots to Detect False Turns and Sideslips of Their Machines in Fogs

RACING LIGHT BEAMS UPHOLD EINSTEIN'S THEORY



Views of Race Course, Observer's Telescope and Starting Mirror Box, in Center; Above, Assistant with Portable Telephones at Corner of Rectangle, and, Below, Adjusting First Mirror

BY sending small beams of light racing through 7,359 feet of water pipe laid out in the form of a rectangle, scientists of the University of Chicago, headed by Prof. Albert A. Michelson, have obtained further proof of Einstein's theory of relativity. The pipe was twelve inches in diameter and ninety-eight per cent of the air was exhausted so that the light beams would have less interference as they sped along at 186,000 miles a second. At each corner of the rectangle, the pipes passed through boxes with mirrors so arranged that the beams were directed around the bends. At the starting point, a shaft of light from an electric arc was sent through a round window into one of the mirror boxes, where a glass directed one beam west and another south. The finish was at an observer's telescope arrangement just

a few feet from the starting point. The beams made a complete circuit of the "track," and as they "broke the tape" at the finish, they made curious fringes of alternate light and dark bands. By study of these, the observers were able to determine that the two beams did not arrive home together. There was a difference of a quarter of a fringe or one-two-hundred-thousandth of an inch. It was explained that since the southern side of the rectangle was nearer the equator, it was moving faster than the opposite side because the speed of the world's rotation increases toward its greatest circumference just as a wheel moves faster at the rim than it does at the hub. One of the beams passed through this more rapidly moving side and was going in the same direction that the earth is turning while the other beam was speeding through the slower side and against the earth's movement. The "running conditions" for the two beams, therefore, were not the same. Under the Einstein theory, light is regarded as having a uniform velocity in all directions, but in relation to the earth, it takes a beam longer to go counterclockwise than clockwise. This idea of relativity may be illustrated by a bird and a moving train. If both are going in the same direction and at exactly the same speed, the bird, in relation to the train will appear to a passenger as though it were merely flapping its wings without making an inch of progress. But a stationary observer by the right of way can see that both bird and train are moving, and he will also be able to detect any variations in their relative rate.

Portable Heater for Thawing Pipes, and Outfit Attached to Concrete Mixture with Flame Directed inside Drum

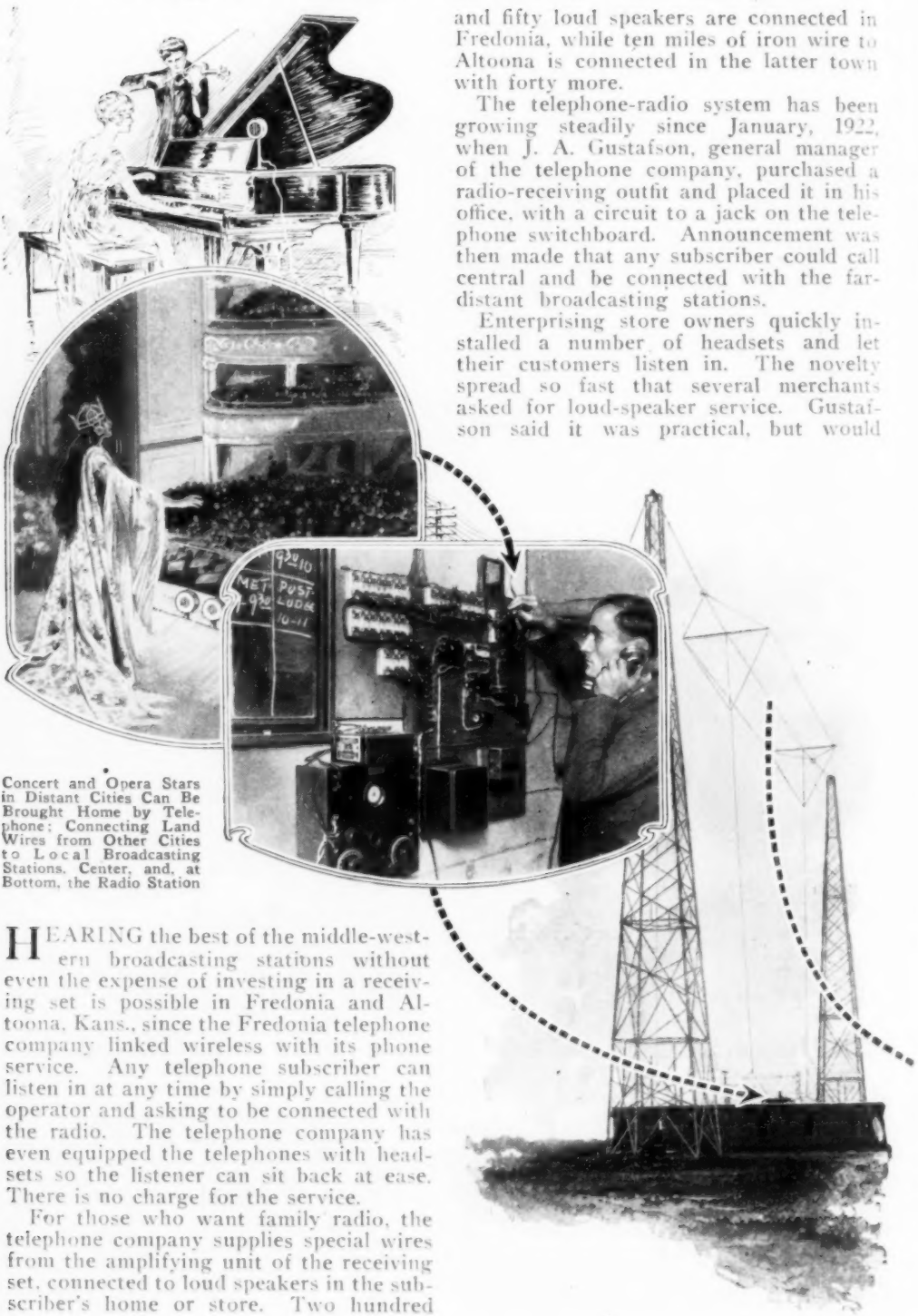
Oil Heaters for Concrete Mixing Prevent Delays in Winter

Kerosene heaters that shoot a hot, steady flame directly into the concrete mixer while it is turning, have been devised for winter construction work to keep the material in working condition and prevent freezing. A pressure tank operated by a hand pump keeps a constant supply of fuel flowing to the nozzle and forces the flames into the mixer. Even in zero weather, concrete can be heated to from seventy to ninety degrees Fahrenheit while in the drum, it is said. At this temperature, it will remain warm for more than fifty hours after pouring. For thawing out pipes, cars, switches and similar tasks, a portable torch that operates on the same principle as the concrete heater has been invented. It is also useful in construction work for melting ice and snow from forms, and both outfits are designed to eliminate costly delays in winter seasons.

Clock Inclosed in Table-Lamp Stand Is Easily Seen and Saves Room

Two household necessities, a lamp and a clock, have been combined in one decorative article for the desk or library table. The clock is provided with an alarm and silencer, and is so placed that the rays from the light above illumine its face. The stand is of bronze, the shade is trimmed with colors to harmonize, and eight feet of silk-covered cord for insertion into a wall socket are included in the outfit. The idea, said to have originated with a woman, saves table and mantel space.

Getting the Radio News by Telephone



Concert and Opera Stars in Distant Cities Can Be Brought Home by Telephone; Connecting Land Wires from Other Cities to Local Broadcasting Stations. Center, and, at Bottom, the Radio Station

HEARING the best of the middle-western broadcasting stations without even the expense of investing in a receiving set is possible in Fredonia and Altoona, Kans., since the Fredonia telephone company linked wireless with its phone service. Any telephone subscriber can listen in at any time by simply calling the operator and asking to be connected with the radio. The telephone company has even equipped the telephones with headsets so the listener can sit back at ease. There is no charge for the service.

For those who want family radio, the telephone company supplies special wires from the amplifying unit of the receiving set, connected to loud speakers in the subscriber's home or store. Two hundred and fifty loud speakers are connected in Fredonia, while ten miles of iron wire to Altoona is connected in the latter town with forty more.

The telephone-radio system has been growing steadily since January, 1922, when J. A. Gustafson, general manager of the telephone company, purchased a radio-receiving outfit and placed it in his office, with a circuit to a jack on the telephone switchboard. Announcement was then made that any subscriber could call central and be connected with the far-distant broadcasting stations.

Enterprising store owners quickly installed a number of headsets and let their customers listen in. The novelty spread so fast that several merchants asked for loud-speaker service. Gustafson said it was practical, but would

require a special circuit direct from the radio amplifier. Arrangements were made to install the special wires and loud speakers on the same basis as ordinary phone rates. As a result several of the two hundred and ninety homes in the two towns which now have loud-speaker service do not and never have had telephones. They subscribed for radio where they had never cared to have an ordinary phone.

When the first summer of the new service arrived, static frequently interfered with clear reception, so the telephone company bought a microphone and gave local programs when outside broadcasting was not available.

Fredonia ministers quickly saw the value of the microphone, and now a Fredonia church service is sent out by telephone every Sunday morning. Radio does not figure in this service at all, the church service coming through the microphone to the telephone switchboard, and going out through the power amplifiers to the subscribers.

Next, Walter Camp's daily dozen exercises were added to the service, being sent out each morning, then the Wednesday evening chapel services at the high school, and finally all local announcements of general interest were put on the wires. "As a local proposition," says Gustafson, "a system such as we have is a valuable asset to the city. It is different than having a radio set. On this system all can be cut in without any effort on their part. With a regular radio set only part of the owners will be tuned in, and then only at the regular hours of broadcasting. With this system they can all be cut in and get all that is put on. It would not even be necessary for us to receive radio from the air, as enough local uses can be found to make the service valuable to the users. If all homes were connected to such a system its benefits would be unlimited. By talking into a single microphone every home could be reached! Think of the educational

Radio Operator in Fredonia Telephone Office, at Bottom, Tuning in for Phone Subscribers; a City Switchboard, Center, and, at Top, Gov. Ben Paulen, of Kansas, Getting His Election Returns in His Home by Telephone-Radio

opportunity! We would all be as one family gathered around the fireplace.

"As to our equipment: A standard-make receiving set is used and connected to Western Electric power amplifiers. Each power amplifier will operate about seventy-five loud speakers. The input of the amplifiers is connected to the output of the receiving set in multiple. Wires in our regular telephone cable are used for this service. Two wires are run from the cable terminals to a house and the loud speaker connected; at the office end the cable pairs are run to the output of the amplifiers; standard telephone repeating coils are used with each amplifier to divide the number of pairs so as to help overcome the loss from the capacity of the cables."

The service is so effective for broadcasting sporting and election results that on election night last fall, Ben S. Paulen, who was the successful candidate for governor, sat at home with his wife and heard the returns come in, broadcast from Kansas City, picked up at the telephone exchange in Fredonia, and delivered to his home over the loud speaker.

The telephone-radio service has also displaced the ticker in cigar stores as a means of getting the returns on sporting events. A loud speaker on the counter gives the results to the crowd at the same time the boy at the blackboard posts them.

The telephone company has trained girls as radio operators and they follow the broadcasting programs, pick up the best of those available and keep the set in tune. They also operate the local microphone and make the necessary radio announcements from time to time.

Fredonia and Altoona stand alone as towns where scores of radio fans always listen to the same stations and hear the same things. To the dyed-in-the-wool fan the inability to tune in another station at will would appear to be the chief drawback to the telephone wireless system. Searching for "DX" is an unknown pastime. On the other hand there are no batteries to buy and keep up, no tubes to replace, no aerial to erect and none of the other expenses or vexations of being a radio owner.

The Fredonia system is spreading to some other communities, and likewise is proving popular in large hotels. A Philadelphia hotel has provided similar radiophone service for every room. To listen to what the wild air waves are saying, the guest calls the hotel switchboard by telephone and is connected to the radio.

The Crowd in a Fredonia Cigar Store Listening to Football Returns Broadcast from a Distant City and Received at the Loud Speaker by Telephone from the Central Office

Armor Needed by Modern Workers about one and one-half per cent of its

Tame Horses Trained to Be Wild for Rough-Rider Contests

Training horses to be wild is now a craft followed by many ranchers of Texas who find it impossible to supply the demands of circuses and rodeos for "outlaw" animals from the free herds. Cowboys employed for the purpose use the familiar method of "confidencing" a pony to convert it into a bucking bronco. This consists in faking falls from the saddle each time the beast shows the least spirit. In a short time the horse becomes more unruly, until it resorts to rough tactics in order to unseat the rider. With repeated rehearsals, the mustang usually assumes a fierceness equaling that of its wildest brothers of the open plains. When it has been tested by expert horse-breakers and found to be a real outlaw bronco, the once peaceful pony is trussed up, much against its will, and shipped to the market, where high prices are gladly paid by purchasers for such animals.

Geyser Harnessed to Steam Pipes to Turn Electric Dynamos

Natural steam, generated hundreds of feet below the surface, has been harnessed with 200 feet of eight-inch water pipe and the skill of engineers, to turn a thirty-five-kilowatt turbine generator near Healdsburg, Calif. The vapor issues from crevices in the rock of what is called Devil's Gulch, and the subterranean "boiler house" is believed to be a tremendous mass of molten lava beneath strata of spongy formations that allow water to trickle through from the top and reappear as steam. Tests are reported to have shown that there are few impurities, a steady flow at from sixty to seventy pounds' pressure is maintained, with a temperature at the nozzles of 335 degrees Fahrenheit. The pioneer who first attempted to harness the geyser suffered many hardships. He sunk two shafts after a number of explosions had imperiled his life, blowing mud and rocks 200 feet in the air. One drawback to complete success of the experiment is that various gases, although found in only small amounts, damage the generators. This is said to be the chief difficulty in a similar plant in Italy, where the steam from an old volcano bed is so mixed with vapors injurious to metal that it is used only to heat other water for making steam for the turbines. Engineers are now trying to design machinery that will not be damaged by these gases.

Roaring Up from Natural Boiler Below, Steam Is Trapped in These Pipes to Turn Dynamos

Air-Tight Tins for Auto Tubes Hold Gas That Preserves Rubber

Folded within hermetically sealed tin containers, inner tubes now being supplied by a western company are packed in a kind of gas which is said to preserve the rubber indefinitely. Moisture is entirely excluded, the tube is prevented from becoming hard and dry in high temperatures, and hollow paper cylinders are inserted in the loops of the tube to obviate kinking and cracking.

Armor Needed by Modern Workers Rivals That of Feudal Knights

Protective armor as elaborate as any worn by knights of old is now used by industrial workers who face the hazards of furnace flames, dust and gases unknown to toilers only a few years ago. Sandblasting, for instance, has developed a helmet of heavy material, fitting entirely over the head with a window for the eyes and a tightly screened breathing opening. Electrical workers on certain tasks wear rubber suits to guard against deadly shocks; more than twenty different kinds of gas masks are in use in industry today; some fifty varieties of goggles, and leather aprons, suits and gloves are worn in tending some kinds of blast furnaces.

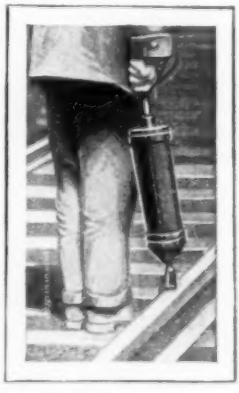
Samples of Worker's Armor, Sand-Blaster's Helmet and Furnace Togs

One-Fourth of Gold Mined Used for Making Coins

What becomes of all the gold mined throughout the world is a query that frequently arises. About one-fourth of the annual production, it is estimated, is used by civilized peoples for coins. Much of the remainder is consumed by industrial arts; waste through wear is another source of loss, a five-dollar gold piece losing about one and one-half per cent of its weight in one year's handling; hoarding swallows up uncounted millions yearly, especially among primitive races, and vast amounts are lost in fires, shipwrecks and in similar ways. Although the value of gold has long been fixed at $20.67 an ounce by the government, its purchasing power at present is only about sixty per cent of what it was before the war, and for that reason, gold mining has fallen off in this country because of the high cost of operations. The annual production from the mines of the world is placed at approximately $370,000,000. Gold bullion priced at $2,501,000,000 was on deposit in the vaults of the United States assay office last year. Incoming alloyed gold is put through several refining processes which sometimes yield as much as 1,500 ounces of platinum, quoted at from $250 to $300 an ounce. This is "velvet" for the government.

Pneumatic Railroad-Track Greaser Reduces Waste and Work

Inner flanges of rails at curves are greased thoroughly and with considerably less waste and work than with a stick, by using a pneumatic implement a western company has devised. It applies grease, oil or compound in proper amounts, and in exactly the places where it is needed, by simply holding it against the rail and pressing down with the handle. The flow is shut off automatically as soon as the holder is raised. A shoe which slides on the rail facilitates the task and helps regulate the quantity of lubricant allowed to reach the inside. The time required for the work is also reduced and this is an aid to safety as well as a saving in money.



jobs are all picked men, most of whom

Aerial Penmen Spread Mile-High Words Across the Heavens from Specially Designed Planes Bearing Smoke-Making Equipment

WRITING messages in smoke two miles above the earth, where everybody for 150 square miles around may read them, is one of the novel after-the-war occupations which grew out of military needs.

Designed primarily to throw an aerial smoke screen around ships at sea or troops on land, the war-time smoke apparatus was left idle when peace came, until Maj. John C. Savage, a Royal Flying Corps aviator, conceived the idea of using it to write advertising messages in the sky. Capt. Cyril Turner, on Nov. 28, 1922, wrote "Hello, U. S. A." two miles above the statue of Liberty, and the new business was born in America. The next day he went up again in a seventy-five mile gale and twisted and looped through space to leave a gigantic scrawl across the heavens: "Call Vanderbilt 7100." That was the telephone number of the flyer's hotel and within a few hours orders had been booked for the initial commercial flights, at $1,000 per flight.

The airplanes used for skywriting are specially built scoutplanes, capable of making a speed of slightly more than two miles a minute. The smoke-carrying ships must have great power, unusual climbing qualities and the ability to be maneuvered rapidly at a height of 10,000 feet without losing altitude. The scout machines have all those qualities and, in addition, are built to a safety factor of eight—eight times as strong as needed to withstand the terrific strains of sharp turns, giddy loops and swooping glides encountered in their work.

Elaborate equipment is necessary to carry out the work of skywriting. The plane carries a load of 2,000 pounds with its intricate smoke-producing gear and the chemicals to make the smoke. Writing is never attempted until an altitude of at least 10,000 feet is reached, in order to insure space in which to glide to a landing field, in event of engine trouble over a crowded city, and likewise because steadier air currents are found at that height. Irregularities in the air, puffs and holes are hard on smoke-written signs, and may, if encountered, dissipate the letters almost as fast as the plane can make them.

In an ordinary airplane of the type used by the aerial penmen, the instrument board is cluttered up with some fifteen controls and recording devices, all of which must be watched by the flyer. Added to these usual instruments, the skywriter has a half dozen dials, levers and indicators, controlling his smoke gear, and besides watching both sets of instruments, he likewise must concentrate on

Skywriting Flyer in His Plane with Aerial Set to Receive Instructions from the Ground

the task of spelling his message by maneuvering the plane through space in the intricate formations of spelling — and spelling backward at that, since most sky messages are written that way. There is no chance of correcting an error when going two miles a minute, no going back with an eraser to rub out a smoke column which is already slowly drifting away before the breeze. Once started, the message must be written to a finish without a stop.

Dashing here and there through the air, the plane emits its smoke column at the rate of 250,000 cubic feet a second. In one minute it covers two miles and leaves behind 15,000,000 cubic feet of smoky letters. The best smoke for the purpose is a Persian orange in color. The skywriters hope soon to be able to send up a fleet of three planes and produce an American flag in three colors of smoke. The pilots who qualify for the writing jobs are all picked men, most of whom made brilliant records during the war. Before a flyer can qualify as an aerial billposter, he is put through a rigorous examination which ranges from mental acquirements to physical tests, and the examinations are repeated at frequent intervals. Besides proving ability as a pilot, he is required to show broad knowledge of navigation and meteorology, of flying by dead reckoning and must be familiar with map reading and general air-traffic rules. His physical examination starts with a lung test with the familiar machine by which lung power is measured by the ability to blow through a rubber tube and lift a weight a certain distance. During the medical examination, a revolver is fired behind his back at irregular intervals to test his nerves, and then he is put to bed in a contraption charged with electricity, while a machine records what has transpired within his heart and other body parts during the experiment as the current is turned on and off. Heart action is registered and respiration studied by the medical examiner before the applicant is finally passed. Altogether these tests consume about three hours.

Maj. Jack Savage, Inventor of Skywriting, Talking to One of His Aviators, 10,000 Feet Above, from a Portable Radio Set

Hydraulic Oil Jack for Automobiles

exhibit areas. A great central rotunda

© Fairchild Aerial Camera Co.

Skywriting in Morse Code, (Inset at Top); a Remarkable Aerial Picture of Three Skywriting Airplanes Flying in Formation While Leaving a Trail of Smoke along Their Course, Center; and, at Right, a Fleet of Six of the Aerial Penmen Preparing to Leave the Flying Field at Garden City, Long Island, to Address a Few Aerial Messages to New Yorkers; the Morse-Code Experiment Is of Particular Interest to Army Officers Who See in It a Quick and Certain Way of Communicating with Large Bodies of Troops in the Field without the Delay Which Would Follow Transmission of Intelligence by Radio and Its Delivery by Messengers to Each Unit

Hydraulic Oil Jack for Automobiles Is Worked like Pump

The principle of hydraulic pressure has been applied to an automobile jack that lifts heavy machines with little effort from

Heavy Automobile Can Be Lifted by Child with Long-Handled Pump Jack That Uses Oil as Working Medium

the operator, prevents sudden jars and drops, and affords constant control by simply opening and closing a valve. Oil is forced against a plunger by working the jack handle with a pumping motion. To lower the car, the handle is removed and placed over the valve at the base. By a turn to the left, the oil is released from the plunger chamber and the weight of the car forces it back to the reservoir. Closing the valve halts the car at any desired point.

National Museum for Industries to Honor Inventors

As a monument to the nation's inventors and to preserve a record of America's progress in industry and engineering, a huge museum is to be erected in Washington, D. C. It will cost $4,500,000, have floor space of twenty-seven acres, and a fund of $5,500,000 is planned as an endowment and to pay for installing the exhibits. To further the project, a corporation composed of representative Americans in the industries and professions already has been formed, and after a year's study of foreign museums, an architect has drafted plans for the building. It will be of Greek design, will occupy a prominent position on the Mall, and provision is made for large storage and workrooms besides the exhibit areas. A great central rotunda will be designated as the "National Hall of Fame for Engineers, Inventors and Industrialists" wherein busts of famous men will be placed. Relics and inventions now in government departments as well as many in the possession of private companies will be displayed in the museum. Where original models or patterns cannot be obtained, replicas, drawings and illustrations will be used to fill the gaps, so that the exhibits will record not only the growth of American industry but, by comparative displays, will show how various inventions have been developed in other countries. It is planned to have the museum depict the complete story of man's industrial achievements wherever he has labored. Establishment of branch museums in the larger cities, privately endowed and supported, is contemplated.

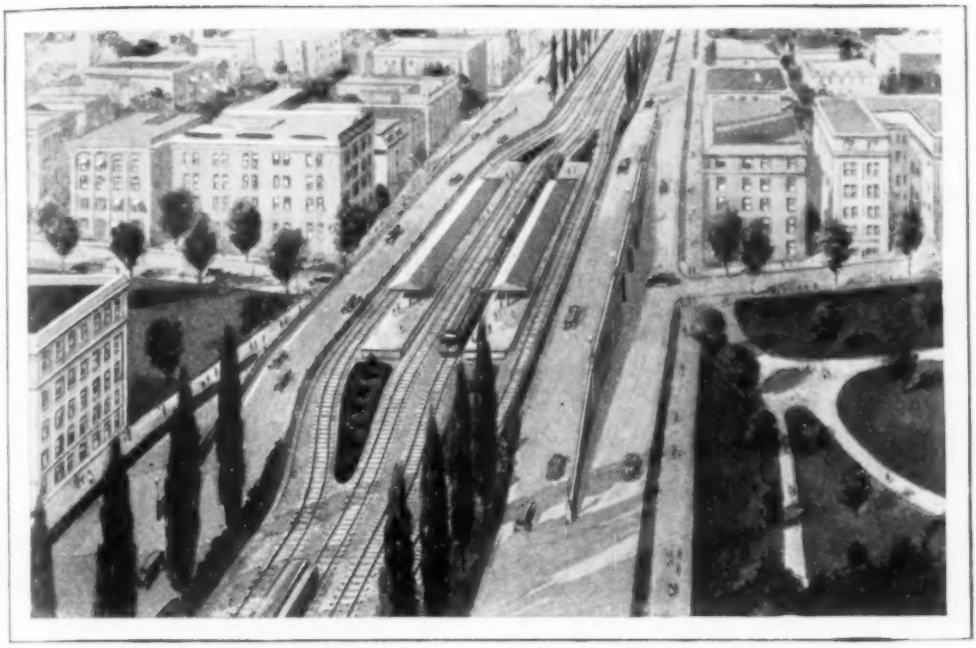
One-Cup Coffee Percolator Brews with Boiling Water Only

To make but a single cup of coffee at a time, a fireless percolator is being manufactured which needs no heat, other than that of boiling-hot water to perform its work. No larger than an ordinary saucer, the utensil requires but a few minutes to brew the liquid. It is of special convenience where only one or two persons are to be served, saving the time and labor necessary to prepare a large pot. Steaming water is poured into the bowl and passed through

Fireless Percolator That Brews Coffee with No Heat Other than That of Boiling Water

finely ground coffee. A filter paper strains the fluid as it drips through the perforated bottom.

Time and Money-Saving Tools



Type of Super-Highway Planned for Detroit, Showing Method of Carrying Express and Through Traffic Overhead at Street Intersections, Where Only Local Vehicle Lanes Connect with Cross Thoroughfares

Super-Highways to Relieve Traffic and Hasten Travel in Detroit

In an effort to relieve present congested traffic conditions and also to provide sufficient travel arteries to care for the community's growth in the next quarter of a century, the city of Detroit is constructing a system of super-highways that will accommodate both electric railways and motor vehicles. On the roads, it is expected a speed of thirty-five miles an hour can be maintained by through traffic at all times and that, on trips now requiring an hour to make, less than twenty-five minutes will be consumed with either automobile or electric car. Twelve travel lanes will compose the road. Four of these will be devoted to tracks for the railway service, and the other eight will be evenly divided between local and through automobile traffic. At intersections with cross streets, only the local lanes of the highway will be built on the level, the express lanes passing over the crossings on raised roadbeds, pierced by archways to permit the intersecting thoroughfares to continue through. All local traffic will be kept in the outside lanes so it can turn off to the street levels where change of direction is to be made. An automatic signal system will control travel at the crossings on the street levels. Where the limits of space will not permit the planned 204-foot width of the highway, the tracks of the railway will be carried underneath by subways, rising to the surface when the road becomes wider. In all, the system is expected to contain 217 miles of highways divided into parallels and radials connected and linked up by a series of circular streets. In this way the city will be divided into areas about three miles square, each bounded on four sides by the super-traffic lanes.

Auto Cigar Lighter and Spotlight Are Combined in One

Utility of the electric cigar-lighter attachment is practically doubled by the addition of a twelve-foot extension cord, equipped with a detachable bulb that may be slipped into place and used as a trouble lamp for inspecting the car at night. A bracket, placed on the instrument board near the lighter, holds the flashlight when it is not needed, and an ash receiver for the "electric match" box is added if desired.

for Woman's Workshop in Home

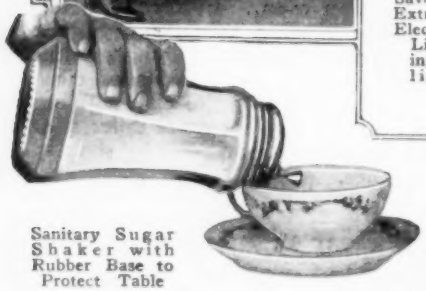
Time and Money-Saving Tools

Rotary Cutter Removes Green Corn from Cobs Quickly and Easily

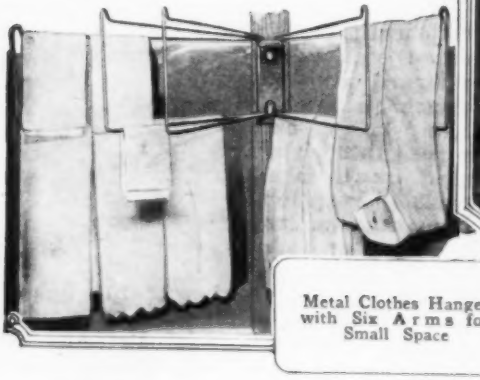
Base for Pots Catches Drippings and Keeps Stove Clean

This Whisk Broom Rotates in Socket to Help Get Rid of Dirt

Window Brush and Squeegee Combined Save Labor and Cost of Extra Tools; Below, Electric Cabinet for Light Housekeeping That Looks like Phonograph When Closed



Sanitary Sugar Shaker with Rubber Base to Protect Table



Metal Clothes Hanger with Six Arms for Small Space

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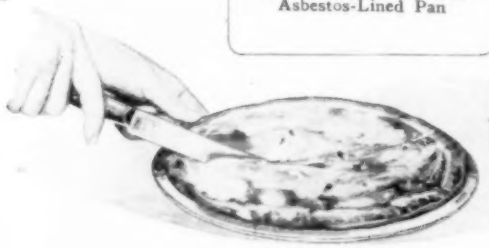
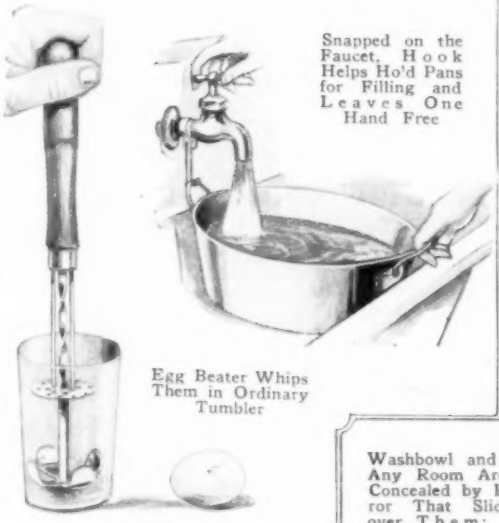
Anyone wishing further information on devices described in the editorial pages can

for Woman's Workshop in Home

Pies Cannot Burn in Asbestos-Lined Pan



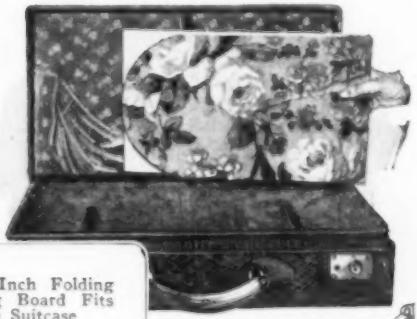


Snapped on the Faucet, Hook Helps Ho'd Pans for Filling and Leaves One Hand Free

Egg Beater Whips Them in Ordinary Tumbler

Washbowl and Shelf for Any Room Are Entirely Concealed by Panel Mirror That Slides Down over Them; Below, at Left, Is Steam-Cooking Cabinet Big Enough to Hold a Whole Meal at One Time

Glass Cutter, Knife and Scissors Sharpener, and Can Opener Combined in One



Thirty-Inch Folding Ironing Board Fits the Suitcase

obtain it by addressing Bureau of Information, Popular Mechanics Magazine, Chicago.

Artificial Larynx Restores Speech to Persons Mute from Cancer

Victims of cancer who have been rendered mute by the removal of the larynx

Artificial Larynx in Use, Vibrator in Hand and Tube Leading to Throat Aperture

or other persons who have suffered the loss of this organ of speech through an operation, are now able to talk again with the aid of an artificial larynx devised by Dr. J. E. Mackenty of New York. The instrument consists of a pad strapped over the aperture cut in the patient's throat after an operation for cancer to enable him to breathe, and a rubber tube leading from this opening to a vibrator device shaped somewhat like the bowl of a pipe. This, in turn, is connected with a shorter tube which is held in the mouth. In operation, air passes from the lungs into the vibrator and thence to the mouth where the sound is modulated just as though it had been produced in the normal manner. A test of the laboratory-made larynx showed that persons were easily understood in an ordinary room although they spoke only in a monotone. The invention already has proved a boon to several persons deprived of the power of speech by operations and has been developed wholly in the interests of science and the welfare of patients.

Dahlia Roots as Source of Sugar Seen as Rival to Cane

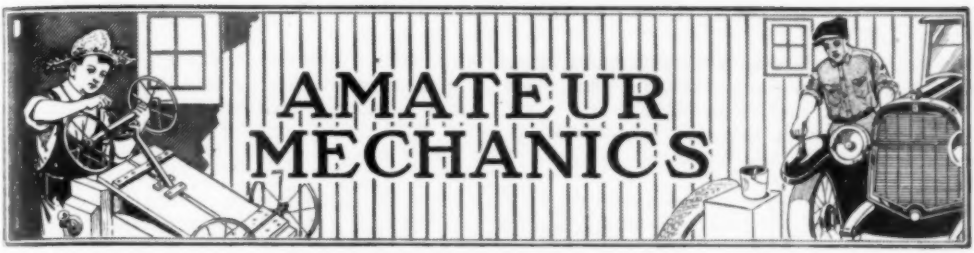
Scientists are reported to have discovered that there is a cheap and easily acquired sugar supply in the roots of the garden dahlia. The plant is said to store up large quantities of levulose, one of the sweetest and most nutritious members of the sugar group, in the form of inulin, a starchy substance that can be extracted by filtering and treating the juice from the roots. They have been found to contain from ten to fourteen per cent of this material, which is also present in the Jerusalem artichoke. Both of these plants can be made to produce from ten to twenty tons of tubers to the acre.

Portable Electric Heater with Fan Keeps Air in Circulation

Proper circulation of the air as well as a comfortable amount of warmth are claimed for a portable electric heater now on the market. It contains a small fan which draws the air in at the top and expels it through side vents after it has been warmed over heating elements that have a range of from 150 to 165°. Weighing only eighteen pounds and but twenty-one inches high, the heater is attractively made of burnished bronze and is operated either with direct or alternating current supplied from a wall or light socket. Burned steadily, it consumes 485 watts per hour. The coils are so constructed that they do not become red-hot. This keeps the outside from being overheated, preventing burns or fires and making the heater safe even with children about. Larger sizes are made for apartments or small cottages, or for installation in homes up to ten rooms.

Cross-Section Diagram Showing Heating Elements and Fan That Keeps Air in Circulation

minals A and D to test the left-hand fuse. the whole wiring system. From this

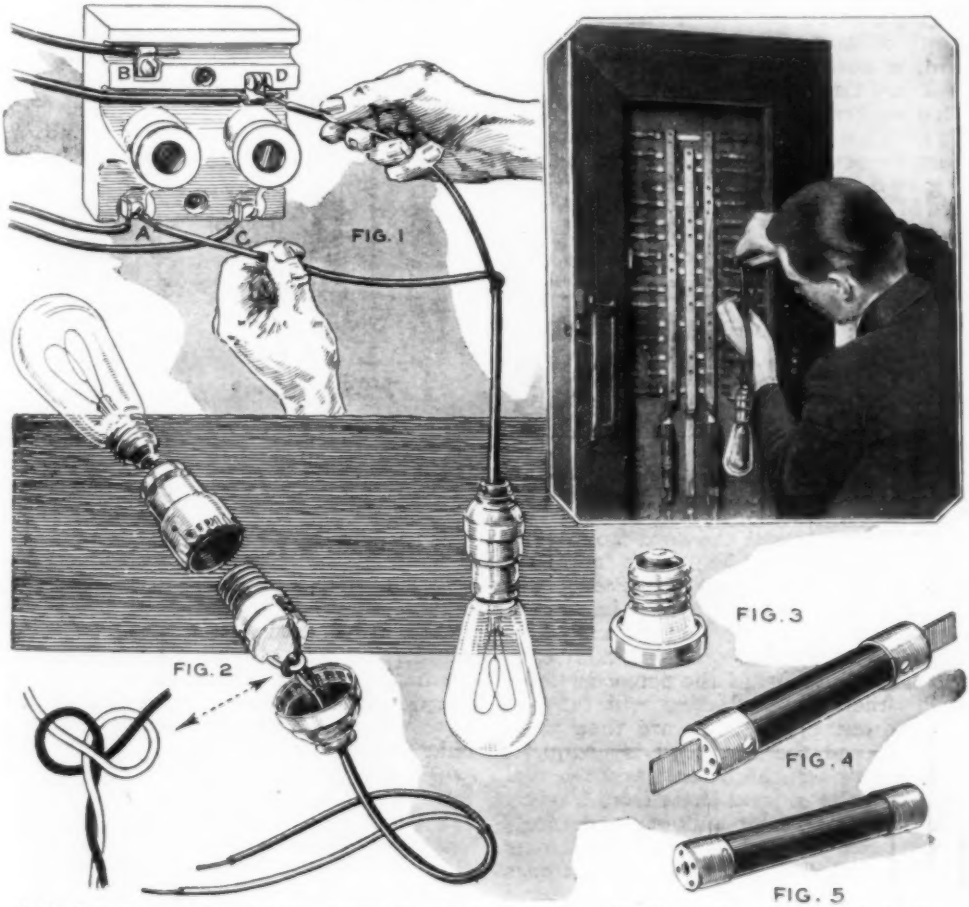


Finding That Blown Fuse

By E. R. HAAN

WHAT do you do when a fuse blows out? Can you go down into the basement and find the blown fuse at once, or must you laboriously screw out fuse after fuse until you find the right one? The latter is no easy job, as nearly anyone who lives in an apartment house has found by sad experience. It is an easy matter to find a blown fuse, however, if one goes about the job in the proper way. All that is required is a simple test lamp which can be made in a few moments.

The method of testing a simple fuse block having two screw-plug fuses is shown in Fig. 1. The wires coming in from above represent the supply line and the wires below the circuit line. The tips of the test lamp are first touched on ter-



With This Homemade Test Lamp Anyone Can Find Blown Fuses No Matter How Complicated the Fuse Panel May Seem, Eliminating the Expense of Calling an Electrician for Such Simple Jobs

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minals A and D to test the left-hand fuse. If the test lamp does not light this fuse is the one that is blown. But if the lamp lights the fuse is in good condition, so the right-hand fuse is tested by touching the cord tips to terminals B and C. The symptoms just described will also indicate the condition of this fuse. Perhaps the lamp will not light in either case, and this proves that both fuses are blown. The test lamp can be made by anyone from a short length of lamp-cord, a socket and a lamp. The socket is first taken apart by pressing on the shell at the points where it is marked and removing the cap, which is then slipped over the end of the cord. Before baring the ends of the wire a knot of the type shown in the detail is made in it, as in Fig. 2, to prevent the cord from being pulled out easily. The ends are then bared and connected to the two terminals. The stranded wire should first be twisted together between the fingers and then wound around the screw shank once, in the same direction as the screw is tightened, otherwise the screw will tend to force it out. The parts are then reassembled, and the test cord is complete. The bare tips of the wires may be coated with solder to prevent them from fraying.

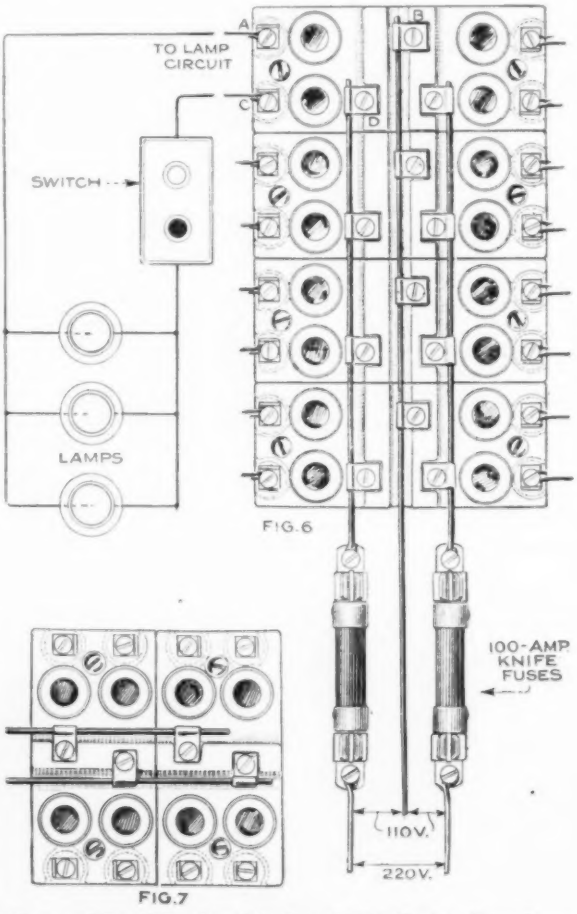


FIG. 6

FIG. 7

Three and Two-Wire Porcelain Fuse Blocks Used in Most Apartment Buildings Having Numerous Branch Circuits

In most apartment buildings the three-wire system is used. Such a system is shown in Fig. 6. The supply line comes in from the bottom of the fuse box and is connected to large fuses, which protect the whole wiring system. From this point three wires or busbars run vertically and the various circuits branching to different parts of the building are tapped off from these. The branch circuits have only two wires each and are tapped in the following way: One circuit is tapped from the left and center busbars; the second circuit, directly across from the first, is connected to the right and center busbars; the third circuit is connected like the first one and the fourth like the second, and so on. This is evident by carefully studying the connections. The wires on these circuits are protected by small fuses, which are those that usually blow out as soon as the circuit is overtaxed or a short circuit occurs. The types of fuses most commonly used are shown in Fig. 3, a screw-plug fuse, Fig. 4, a knife fuse, and Fig. 5, a cartridge fuse.

Now, although it is not at all dangerous to test fuses, it is, nevertheless, advisable to refrain from touching bars, wires, or terminals with the fingers, otherwise a very unpleasant shock may result. Of the three wires running vertically the outside ones have a potential of 220 volts while the potential between the center wire and either outside one is 110 volts, on which the house-lighting system is operated. In no case should the test lamp be connected across the 220-volt leads; it would then immediately burn out, as it is made to light at 110 volts.

Portable Picnic Cupboard

Cement for Amber

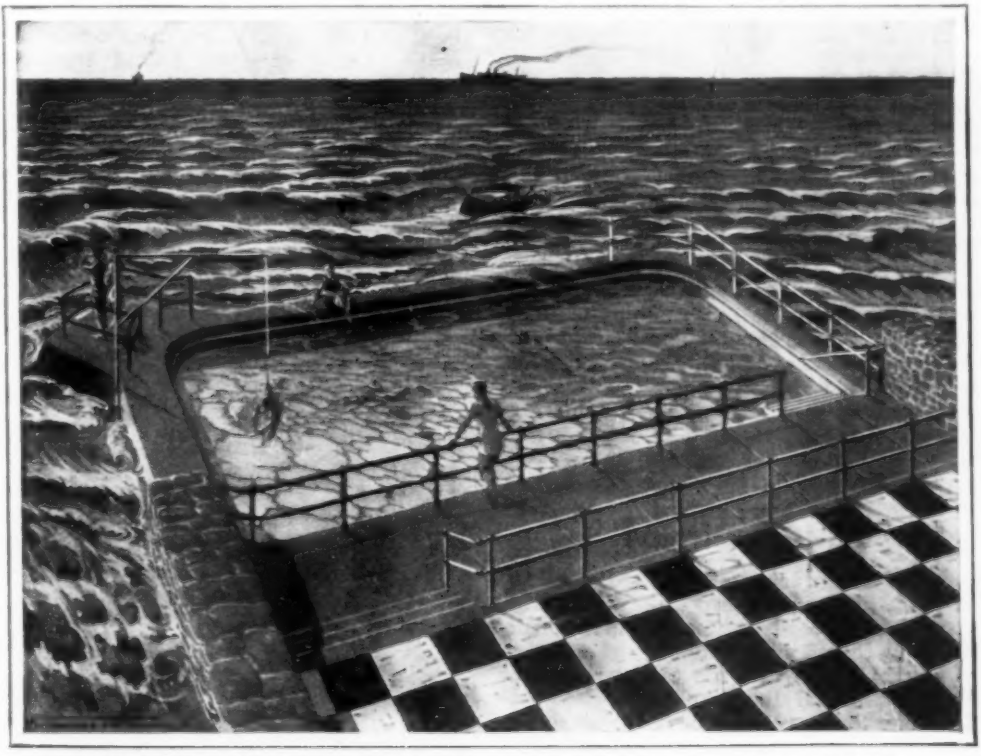
When the apartment circuits are not marked between fuses or terminals, as is often the case, it may be necessary to test every fuse on the panel. This seems, at first glance, a difficult job but is really easy. The same method is applied as explained above, no matter what kind of fuses are used. The testing can be followed out easily in Fig. 6, which shows four two-circuit porcelain fuse blocks. The wires leading to a branch circuit with its switch and lamps are shown at the left. Terminals B and D are on the supply line and terminals A and C on the branch circuit. Tests should be made across A and D and across C and B as previously explained. In small towns where the three-wire system is not used extensively, there are only two supply lines, having a potential of 110 volts. They are connected to porcelain fuse blocks, as shown in Fig. 7. The tests on these are made in exactly the same way.

The usual causes of blown fuses are short circuits and overloads of current, that is, more current is used in the circuit than the fuse can carry without melting. Most house fuses are designed to carry 10, 15, and 20 amperes; even 30-amp. fuses are sometimes used. A 60-watt tungsten lamp takes approximately .6 amp. on 110 volts, so 16 of these lamps can safely be used in a circuit protected by 10-amp. fuses. Electric irons and electric stoves and other heating devices take much more current. The usual types of irons take about 5 or 6 amp., so if a number of lamps consuming about 8 or 9 amp. are lighted, and then the flat iron is plugged in, the fuse will most likely blow out.

Makeshifts, such as coins or pieces of metal, should never be used to connect the two sides of the fuse.

Bathing Pool Built at Water's Edge

A novel and attractive pool has been constructed by a summer resident of an eastern resort, at the edge of the sea, so that his guests may enjoy the invigorating salt water and fresh air, without going to the crowded beaches and safe from rocks and undertow. The concrete of the approach is laid in squares, and the concrete for alternate squares mixed with red dye to give a tile effect. The pool is kept filled by the waves washing over the low wall in front, and pipe rails are set around the pool for additional safety of the users. —Richard C. Tarr, Gloucester, Mass.



Large Bathing Pool at Water's Edge Provides Comfort, Privacy and Safety from Rocks and Undertow

Making Useful and

Portable Picnic Cupboard

For families spending week ends at the lake, the portable picnic cupboard shown in the drawing is just the thing for carrying pies and other provisions that must not be crushed, and it is also useful for storing pies and cakes at home. It is made of ½-in. wood, cut as shown. The sides are grooved to receive a sliding door made from a piece of heavy galvanized sheet iron. Holes are drilled through the top of the sides for a length of broomstick, which is used as a handle. The shelves are also made from galvanized sheet iron, having the edges bent over so that they can be screwed to the sides and back. When the cupboard is used for storing provisions at home, a screen door is substituted for the sheet-metal door. This can readily be made by soldering screen to a doubled band of sheet metal or wire, bent to the correct size.—Margaret Vogt Siddall, Moravia, N. Y.

A Portable Picnic Cupboard Is a Convenient Accessory for Picnickers and Can Also Be Used to Advantage in the Pantry

Driving Small Tacks

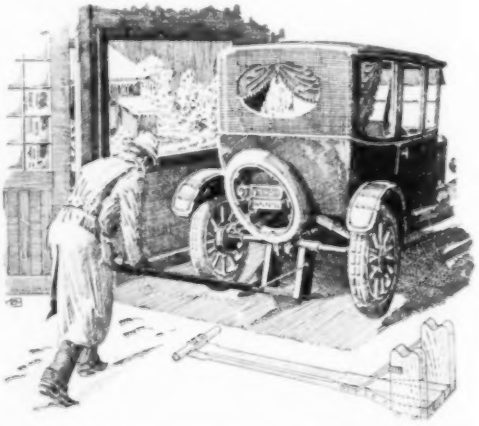
When using tacks or brads too small to be easily held in the fingers, take a strip of thin cardboard or heavy paper, push the tack through it, and hold the paper with one hand while the tack is started. A slight pull will then tear the paper away. This method may also be used to drive nails in places that are almost inaccessible. —Donald R. Barnett, Missoula, Mont.

Cement for Amber

Amber can be effectively cemented by means of shellac, dissolved in grain alcohol. The parts must be thoroughly cleaned, and after cementing they should be held together in clamps for a few days. The surplus cement is then cut off with a sharp knife and the amber polished with a piece of felt, using dry-lump tripoli and water and finishing the job with a clean rag. Boiled linseed oil can also be used as a cement instead of shellac; it is applied in the same way, but the parts must have more time to dry.

Simple Wooden Jack

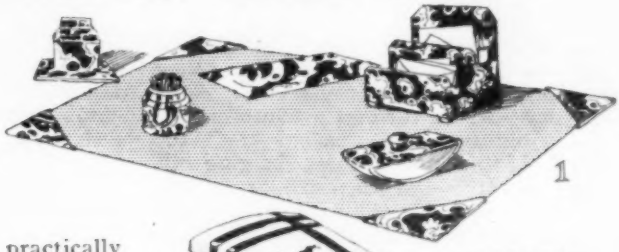
An inexpensive rear-end jack, which will be found to be of considerable use around the home garage, especially in winter, when it is often desirable to use a jack in starting the car, can readily be made by anyone. It is made of 2 by 4-in. wood. One piece is about 5 ft. long; a handle is bolted on at one end and two blocks at the other. The blocks are grooved at the top, as shown in the detail, and are separated from each other about 12 in., which can be done by using short pieces of 2 by 4-in. wood between them and the 5-ft. length, the whole assembly being securely bolted together with ⅜ or ½-in. carriage bolts about 16-in. long. Flat-iron braces may also be used to hold the blocks more securely. In use, the jack is slipped under the rear axle, as shown in the drawing, and the handle is pushed down to lie flat on the ground, which will raise the rear end so that the wheels clear the floor a few inches.—G. C. Douglas, Raleigh, N. C.



Rear End of Auto Can Be Quickly Raised by Means of Simple Homemade Jack

an old cigar box. Sheets of cardboard are ... to the edge of the circle. Draw 11 ...

Making Useful and Attractive Novelties from Odds and Ends with Glue



EVEN nowadays, when practically everything from matches to grand pianos is at one's elbow, so to speak, it often seems the hardest thing in the world to discover during a shopping tour just the type of candle shield, waste-basket, wall hanging, dressing-table appointments or desk set that one had in mind when starting out. In spite of the immense variety to choose from, it seems that nothing one sees will harmonize with the furnishings of the particular room in which the things are to be used, or else they are not individual enough to suit the taste. The only thing that is left is to make them at home, and this, to many people, seems an almost impossible task.

There is, however, a simple and easy way to make the many little things so dear to the heart of the housewife, and that without a particle of sewing. The process is called "gluecraft," and, with the aid of a ten-cent tube of glue and some scraps of silk, cretonne, brocade or any other suitable covering, the article can be made in much less time than by sewing. Nor is the process a messy one. With a little care, there need not be a drop of glue on the fingers when the work is finished. The tubes of glue come with a little spreader in the top, with a convenient handle, and the fingers need not come in contact with the glue at all.

Before proceeding with a detailed description of the making of a particular article, the reader's attention is called to the pen-and-ink illustrations on this page, which were all actually made by the method of gluecraft. No. 1 is a desk set, a complete description of which will be given farther on in the article; No. 2 shows a charming jewel case, made from

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an old cigar box. Sheets of cardboard are used to cover the top and the inside bottom of the box, and are heavily padded with sheet wadding, then covered with white moire silk. Bands of black silk ribbon, 1 in. wide, are glued over this, and a small black silhouette, which can be obtained at any art shop, glued in one corner. The glue, which is LePage's, is applied very sparingly to this, so that it does not spread. This glue will not stain the most delicate fabrics.

When applying the glue to any kind of cloth, one precaution is necessary. Allow time for the glue to become "tacky"—almost dry—before turning a hem over, or before joining two pieces of cloth together. If this care is taken, the glue will never come through the cloth or spot it.

No. 3 shows how a humble coffee can may be transformed into an attractive wastebasket. Rows of scalloped ribbon are glued onto cretonne, which is then laid in shallow plaits. Glue is lightly and evenly spread directly on the tin, around the top and bottom edges, and the inside ridge of each plait pressed to the tin and held firmly for a few moments. Scalloped ribbon, lightly gathered, is then glued around the rim at the top. In No. 4 is shown a telephone screen that will add a note of color to the nook where the phone usually stands, besides hiding the instrument. It is made of heavy cardboard (part of an old carton will serve nicely) and the edges are bound with seam binding or narrow ribbon, glued on. Cretonne or silk is then stretched over the outside, pressed to glue spread on the cardboard, and allowed to dry. The frame is then lined, and the edges bound with novelty ribbon lightly glued on each edge. A little telephone pad may be covered and lined to match.

An ordinary pair of metal book ends may be covered to match the accessories in any room in the house, as shown in No. 5. A square of cardboard is glued to both sides of the uprights. Then the ends are padded and covered with cretonne or brocade, and a double-edge scalloped ribbon used to bind the edges. When fastening the ribbon, the glue is applied only a few inches at a time. Coverings for flowerpots are easily made as shown in No. 6, with black sateen and novelty ribbon neatly glued to a foundation of cardboard or buckram. A coffee tin also makes an ideal foundation for a flowerpot covering.

A novel and attractive doorstop is that shown in No. 7. Fill a pint bottle with sand, and glue to it a circle of cardboard, 7 in. in diameter; then pad with cotton to the edge of the circle. Draw black sateen around the foundation and glue a seam at the cat's back. Glue the sateen to the base, tie a cord around the neck, and embroider the features, legs and tail. Glue the edges of the head together, turn it on its side, stuff the head through an opening left in it, and glue to the neck of the bottle. Use green beads for the eyes and tie a ribbon bow around the neck.

No. 8 shows a whisk-broom holder that is decorative as well as useful. It is made by padding a cardboard shield with sheet wadding, then covering it with silk, gluing the raw edges to the back. A band of cardboard, to hold the broom, is also padded, covered with silk, and the ends passed through slits cut in the shield and glued to the back. A piece of silk is glued to the back and all the edges are bound with narrow ribbon. It hangs by a tiny ribbon loop. In No. 9 a little china doll tries to cover the lid of an old cardboard box, converted into an attractive dressing-table box, with her very full skirt. The box is divided into compartments for hairpins, powder, etc., and is lined with glazed chintz. The doll is glued to the cover, and the whole box is covered with silk and novelty ribbon. The tiny sewing kit shown in No. 10 will prove of value to the woman who travels. An empty salt container may be used as a foundation for this. Padding is glued over the container, the inside lined with silk and the outside covered with cretonne. Ribbon is used to trim the finished kit.

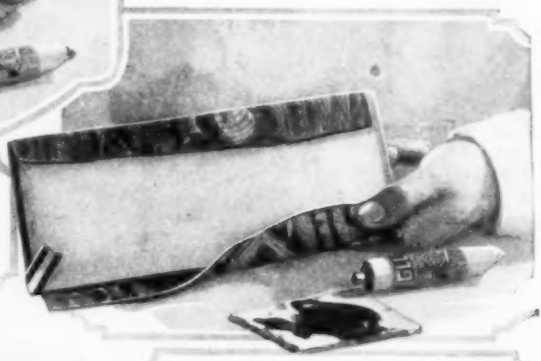
To acquaint the reader more closely with the process, the making of a desk set will be described and illustrated, step by step. The "props" are an inexpensive desk pad, inkwell, and paper cutter obtained in a department store, with a paper holder made from an old stationery box and a cardboard pen tray and blotter top. A tube of glue, scissors, a piece of cheesecloth and a little water to keep the fingers clean while working are all the "tools" necessary. The metal spreader that comes with the tube is often the only implement used to spread the glue, although many workers prefer to use the tip of the little finger, or an ordinary nutpick. The most important thing to remember in this work, as previously mentioned, is to use very little glue, merely touching it to the material when partly dry, so that it cannot penetrate or discolor the fabric. To facilitate this, the glue is squeezed out onto a dish, and allowed to dry partly before using.

The leather ends of the desk pad are first covered with brocaded ribbon rich

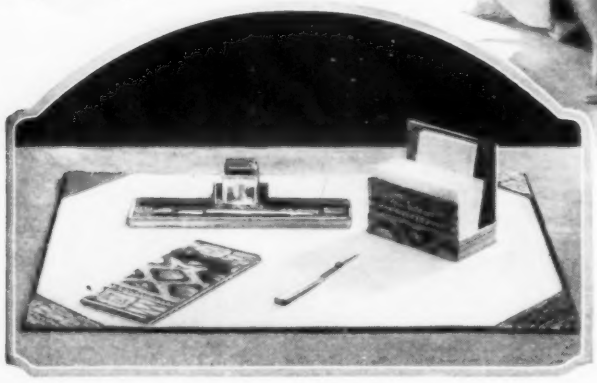
The Glue Is Squeezed Out onto a Dish or Square Card
A Thin Line of Glue Is Spread on the Ribbon Edge
The Glue Is Spread over the Surface of the Desk-Pad Corners, and Allowed to Set Until It Is "Tacky," or Almost Dry; the Ribbon Is Held Firmly as Shown
When the Glue Has Set Until It Is Partly Dry, the Ribbon Is Pressed Down into Place with the Fingers; the Selvage of the Ribbon Eliminates the Need of Folding
Ready to Commence Operations on the Desk Set

Left, the Ribbon Is Cut to Fit the Inside of the Tray and Glued; Right, the Glue Is Applied Directly to the Inkwell and the Material Stretched Over

Above, Applying the Ribbon to the Blotter Pad; Note the Binding Ribbon on the Edge; Right, the Edges Are Folded over the Back, Glued, and Covered by the Blotter When Glued in Place



Left, Covering the Paper Box; Below, How the Front Is Fitted



Left, the Completed Desk Set, Distinctly Individual and Harmonious

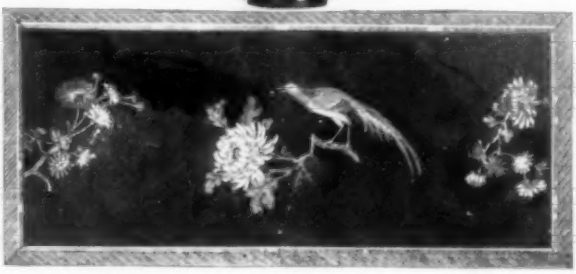
in design; of course, any other suitable material that may happen to be at hand may be used instead. A thin line of glue is applied along the edge of the ribbon as a start; after the glue is partly dry, the ribbon is pressed into place, the ends being glued underneath. The selvage of the ribbon eliminates the necessity of folding it in. Hold the ribbon firmly, and stretch it as shown in the illustration. If desired, a narrow binding ribbon of suitable material can be applied along the edges.

When covering the pen tray, the ribbon is cut to fit the inside, and binding ribbon applied, as shown, around the rim, both inside and out, covering the raw edges. In attaching the ribbon to the inkwell, apply the glue directly to the glass in a thin line, and stretch the material into place, mitering the corners carefully. The blotter is next, and if, in making the cover, the ribbon is of the same width as the cardboard, the binding ribbon can be applied first, as shown. The raw edges on the back are covered by gluing the blotter over them as a lining. The paper holder is covered by first lining the inside, front and back. Then dull-gold ribbon is applied to the low sides, inside and out, and the box finished with the outer brocaded

ribbon. When covering the front, it is necessary to slit the ribbon sufficiently to allow it to be turned over the edge and under as a seam when it reaches the side.

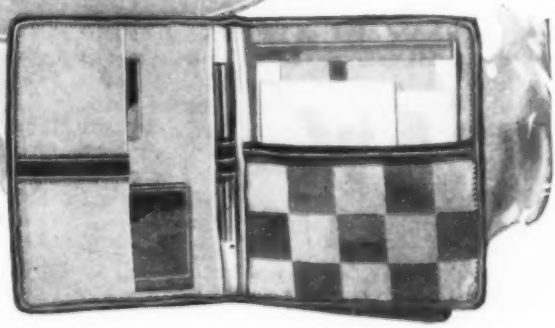
The finished set is decidedly individual, and has the added merit of being inexpensive. It demonstrates the versatility and effectiveness of this process.

It is impossible to cover in one article the endless variety of things that can be made in this way. One of our illustrations shows a handsome table runner that was made without a single stitch. It is made from a strip of black satin, to which 1-in. wide ribbon, with shimmering oblique stripes, is glued as a border. Green and gold metallic ribbon is used as an inside border. A thin line of the glue is applied along each selvage of the ribbon, a few inches at a time, and allowed to become nearly dry before the ribbon is joined to the satin. The brilliant flowers and the slender-tailed bird are applied with the slightest possible touches of glue around the edges. Cut-outs from chintz and cretonne, glued on silk fabrics, are exceedingly effective for this purpose.



A Lamp Shade and a Handsome Table Runner Made Entirely by Means of the Gluecraft, without Any Stitching

Lamp shades, too, are easy to make, and have a very "professional" look when put together with glue. The frame is first wound tightly with seam binding, secured at the ends with a touch of glue. A line of nearly dry glue is next applied along the frame and faille ribbon stretched over it in sections. Gold ribbon covers the upright wire bars, and double-scalloped ribbon with a drawthread running through the center is glued on as a finish. A tray for calling cards is easily made from a shallow cardboard box covered with a scrap of rich brocade ribbon, and lined with a plain ribbon. An ordinary cold-cream jar takes on a distinct charm when covered with a bit of gold satin, trimmed with black and silver plisse ribbon, and finished with a dainty silhouette of the Marie Antoinette era. Glue in a thin line is spread around the top and bottom of the jar, and the satin stretched over it. The glue is then lightly touched to the ribbon, which, in turn, is pressed into place. A most useful writing case is made of cardboard and ribbon with the aid of the glue. Two pieces of the cardboard are cut to the

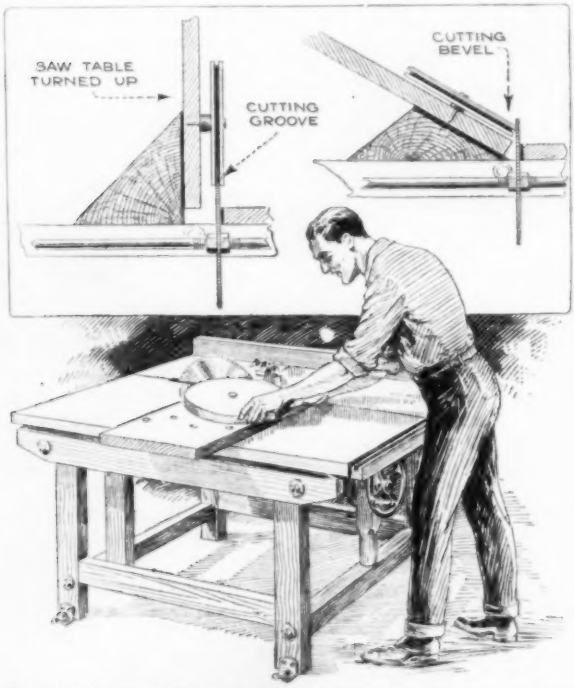


Above, an Easily Made Calling-Card or Pin Tray; Left, a Transformed Cold-Cream Jar, and Right, a Useful and Ornamental Writing Case

desired size and padded with a single sheet of flannel. A heavy and colorful lining ribbon is then stretched over the cardboard at the center, forming a hinge. The two pockets are then glued on. A checked satin ribbon covers the outside, and the whole is finished with a picot-edge ribbon, glued on last.

Turning Wooden Disks on Circular Saw

For the amateur mechanic or woodworker who is not equipped with sufficient funds to provide himself with a lathe, the following method of cutting round disks with a common circular power-driven saw



Simple Fixtures That Enable the Amateur Woodworker to Turn and Groove Disks on the Saw

will prove helpful many times in construction and repair work of all kinds. Small pulleys, useful in model making, small wheels, and drums of all kinds can be fashioned without the use of an expensive lathe. If the saw is a homemade affair, the table will probably be of wood, in which case the board carrying the work can be nailed to it. If the table is made of iron it will be necessary to clamp a board a few inches larger than the wheel or pulley to be sawed to the table top in order that a nail may be driven into it. The board should be at right angles to the side of the saw. When the size of the pulley is determined, a board of the proper thickness should be cut square and the center found by drawing lines from corner to corner. Nail this board to the table or the clamped-on board with one nail. The nail will have to be of sufficient length to hold the board securely in place while it is being rotated and the square board fixed so that the edge just touches the saw as it cuts. To cut the pulley or circle from the square, saw off the corners by pushing the table forward, drawing it back and continuing the procedure until all of them are sawed off. Then the pulley can be rotated on its pivot and the circle will be cut perfectly. If, after the circle is cut, a groove for a round belt is to be made in the rim, it may be done by constructing a light angle bracket and driving the center nail through the wheel and into the bracket as shown in the diagram at the upper left. The saw is then adjusted so that the desired amount of cut is attained (by lifting the saw table) and the pulley slowly turned until the entire rim is grooved. In making a set of wagon wheels or similar disks, the corners of the circle are cut off after the groove for the tire has been cut in the rim. The circle is pivoted with a nail on a bracket so that it is at the right angle. The drawing shows the angle piece that is fixed to the saw table for the wheel to rotate upon while making the "disk wheel" effect.—Wilbert Whitfield, Fremont, Nebr.

Removing Dents in Fenders

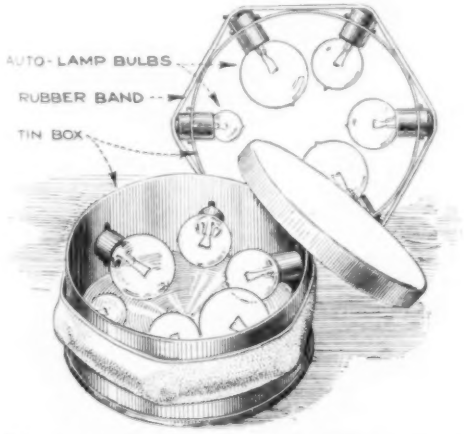
Dents in automobile fenders and body mar the appearance of the car considerably. Some of the dents can be hammered out with a lead mallet, but in many cases this will not entirely remove them. A more effective way is to fill them with solder. The paint is first rubbed off with a piece of emery cloth, and after applying flux, the solder is melted into the depression, the torch flame being played against the underside of the metal, if possible. After enough solder is applied to project a trifle above the surrounding surface, it is allowed to cool and is then filed and sandpapered down until perfectly flush. It is, of course, necessary to complete the job by repainting the repaired places. The same method can also be used to conceal deep scratches.

Repairing Gasket on Barrel Churn

The cork gasket on the cover of a barrel churn is usually the first part to wear out. This trouble can easily be remedied with a little work in one's spare time by first removing all the iron trim from the wooden cover, which will permit the cork gasket to be removed without any trouble. The iron trim is then replaced and the groove where the gasket was, is filled about one-fourth full of plaster of Paris. The cork gasket is replaced upside down and pressed in so as to make an even job. The soft plaster will fill in all uneven spots that may be left underneath and also make a tight joint.—Adolph Rieter, Marinette, Wisconsin.

Holder for Auto Lamps

Auto lamps can be carried along conveniently and without risk of breaking them in the tin-can holder shown in the drawing. A small can of the kind used for the soft gritty soap used by mechanics, or of similar size, is perforated with a number of holes, just large enough to receive the base of a lamp. Two small slots are cut on opposite sides of each hole to permit the pins on the bases to pass through. The lamps are pushed through the holes from the inside and then given a quarter turn, so that the pins prevent them from coming out. A rubber band cut from an old inner tube is stretched around the outside, as shown, to hold all the lamps still more securely. So supported, the bulbs

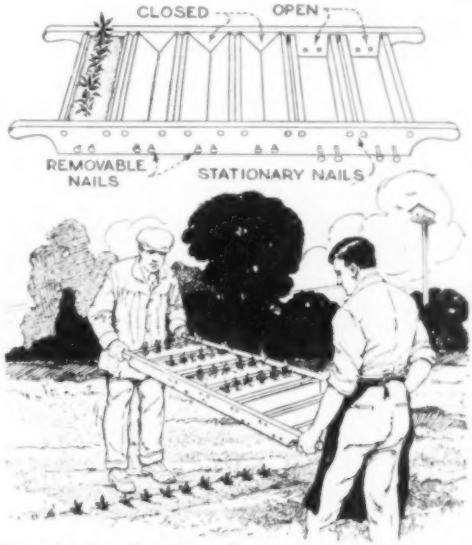


Tin-Can Holder for Auto Lamps Eliminates Danger of Breaking Them

will not touch each other and are practically safe from breakage no matter how rough the roads may be.

Collapsible Seedling Box

With the use of the seedling box shown in the drawing, transplanting to the garden can be done without any interruption



Transplanting Seedlings Grown in Collapsible Box Does Not Affect Their Growth

to the growth of the seedlings. This box consists of a wooden frame, as shown in the detail, with stationary and removable nails driven through the sides to hold a number of boards set with edges together to form V-shaped troughs. The troughs are filled with earth in which the seeds are planted and spaced the same distance apart as they are to be in the garden. The box is then set in a place having the correct temperature for the growth of the plants. When it is time to transfer them, furrows are dug to receive the earth and plants contained in the troughs. The box is then set over the rows and the removable nails pulled out. When the frame is lifted, the boards swing away and the seedlings are neatly deposited in rows. Thus several short rows can be planted at once, or one long row by repeating the operation with one trough of the frame at a time. The roots of the plants will not be loosened and growth will not be affected in any way.—Dale R. Van Horn, Walton, Nebr.

¶ No-parking signs to be placed at the entrance of a garage were quickly and cheaply made from a discarded Ford rear-axle housing. Pipes were split at one end to accommodate the signs, and firmly riveted to each half of the housing.

Reel for the Garden Hose

The hose reel shown in the photo was made entirely from parts that are easily obtainable almost everywhere. The reel, which turns in the frame, consists of two wooden disks, 20 in. in diameter, mounted on a pipe axle, which turns on a long bolt run through the frame. The frame is made of 2 by 2-in. material and the cross-pieces are held in place by flat-iron braces. When the hose is rolled up after use, the reel should be turned by hand slowly, which will cause all the water to flow out of it, because the hose will not get kinked on the round axle. Thus this reel will double the life of an ordinary garden hose.

Curing Wet-Weather Ignition Trouble on Ford Automobiles

Older models of the Ford occasionally give trouble with the ignition system in wet weather due to water leaking down between the hood and cowl. Some drivers tack rubber covers over the projecting porcelain terminals on the dash, while others cover the joint of hood and cowl with a strip of rubberized fabric in order to protect the ignition during a storm. Neither of these remedies, however, really cures the trouble; the simple method explained below does.

Back of the coil box is the board from which the terminals project. This board becomes wet, and allows the current to leak between the terminals, thus rendering the system inoperative. For permanent relief from this trouble the board should be waterproofed. Detach the ignition wires from the posts, taking care that the battery wire is not allowed to touch any metal part of the car; to do so would ruin the battery. The four nuts holding the coil box to the dash are removed and the box taken off. The coils themselves are thoroughly impregnated with insulating material and need no attention; so they are taken out and laid aside until the box has been treated. It is best to unscrew all posts and remove the porcelain terminals, so that the whole board can be waterproofed. This is a little difficult with the battery and magneto posts, but by unscrewing the boards from the bottom and sides of the metal box, it can be done without unsoldering the posts.

Put the board in a hot oven while preparing the waterproofing material. This may be ordinary paraffin or melted candles with the wicks removed. When the board is dry, place it in the melted wax and allow it to boil for a short time until it appears to be thoroughly soaked. Then take it out, stand it on edge to drain, and replace the terminals. The coils can now be put in place and the board reinstalled on the car.

This method has been tried on two cars that had given a lot of trouble with ignition in wet weather, even with covers over the hoods. After the treatment no trouble was experienced, although no covers of any kind were used.—R. C. Hitchcock, Manchester, Vt.

Making Pipes "Sit Up"

By flattening the underside of pipe bowls so that they will "sit up" unsupported, the customary trouble of dropping ashes on the table can be eliminated. The work is done with a wood rasp, which is laid on the table or bench, and the pipe is then rubbed over it, holding the bowl in the palm of the hand. Do not bear down on the stem part very much as it is only the bowl that has to be flattened. The effect should be to make the stem slightly tilted, to prevent it from leaking when the pipe is set on the table.—Frederick Boesser, Arlington, N. J.

Flattening the Underside of the Pipe Bowl Permits It to "Sit Up"

How to Fire the Furnace

MOST domestic furnaces are fired in a haphazard manner, and are not only industrious producers of smoke, but, as a result of this, are not so economical of coal as they should be. It is a very easy matter to fire the furnace properly, and, even if the "lady of the house" must do the job most of the time, it takes but a few minutes to show her how to do it properly, and it is not any harder to fire it correctly than to do it as it is usually done.

A furnace that is producing a quantity of smoke is one that is not completely consuming the fuel. The smoke given off contains tarry vapors that should be consumed in the firepot; if they are not, the heat contained in them is simply wasted. To consume these vapors, and, consequently, to reduce the smoke given off, it is only necessary to see that the coal is fed to the fire so that there is always a bed of glowing fuel in some part of the firepot. The vapors, in passing over this glowing bed or through the flames arising from it, are ignited and consumed.

There are two simple methods of accomplishing this. The first is shown in Fig. 1, and consists in alternating the feeding of the fresh coal from one side to the other. That is, when the furnace is fired one time, the fresh fuel is thrown on the fire at the right side, as indicated at the left in the drawing. The next time it is fired, the coal is thrown on at the left side. In this way, there is always a bed of burning fuel to one side of the fresh coal, and, as the latter heats, or cokes, and starts to give off vapors, these are ignited and burned as they rise. The second method is similar, and is shown in Fig. 2. This shows a side view of the furnace, and in this case the coal is fed to the front of the fire always, the old fire being pushed to the rear of the firepot before the fresh coal is thrown in.

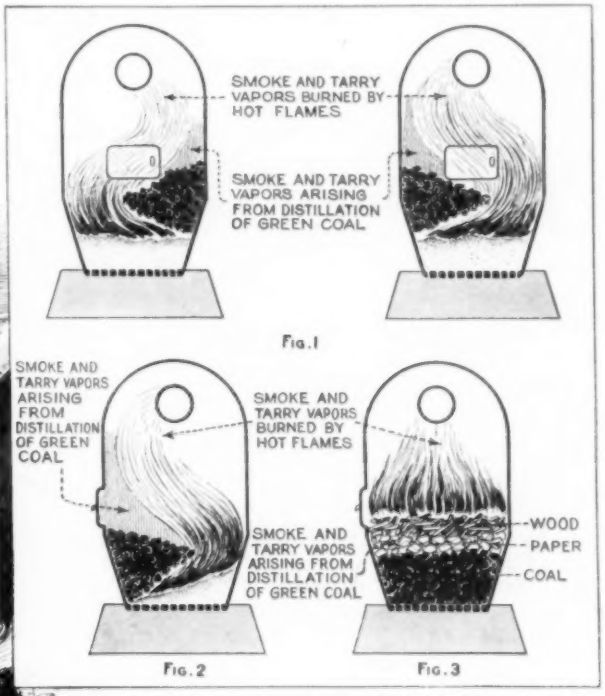

SMOKE AND TARRY VAPORS BURNED BY HOT FLAMES
SMOKE AND TARRY VAPORS ARISING FROM DISTILLATION OF GREEN COAL
Fig. 1
SMOKE AND TARRY VAPORS ARISING FROM DISTILLATION OF GREEN COAL
SMOKE AND TARRY VAPORS BURNED BY HOT FLAMES
SMOKE AND TARRY VAPORS ARISING FROM DISTILLATION OF GREEN COAL
WOOD
PAPER
COAL
Fig. 2
Fig. 3

Fig. 1, Firing the Furnace on Either Side Alternately; Fig. 2, Effect of Firing at the Front; Fig. 3, Proper Method of Starting the Furnace Fire

The proper method of lighting fires in furnaces is to place coarse coal on the bottom next to the grate, with paper or other light combustibles on top of the coal and the kindling wood on top of the paper, as in Fig. 3. The light materials on top of the coal almost immediately rise to the proper temperature for complete combustion, and have the effect of consuming the gases distilled from the coal as they rise, with a consequent great reduction in the smoke incidental to starting the fire. The dampers should be adjusted for full draft, and left on until the fire is well under way.

It is the opinion of government experts

that, without changing the furnaces, except as to method of firing, a smoke abatement of from 50 to 75 per cent can be obtained. Smoke abatement is not only beneficial from the standpoint of economy, but as domestic smoke is made in localities where maximum damage to health and furniture results, it is to the advantage of the householder to endeavor to fire the furnace properly.

Revolving Mail-Box Support

To avoid the necessity of crossing a muddy ditch to get his mail, a farmer built the swinging mounting for the mail box

Revolving Mail-Box Support Eliminates Need of Crossing Muddy Ditch to Get Mail

shown in the illustration. The box is supported on an arm made of two 2 by 4-in. pieces, long enough to reach the road across the ditch. These lengths are spaced about 2 ft. apart at one end, where they are bolted to a buggy wheel, and come together at the mail-box end. The wheel is mounted on an axle, set in the ground and braced by a chain running from the top to a stake as shown; a coil spring also connects the wheel rim and the stake. When it is necessary to get the mail, the arm is swung around, bringing the box within reach, and as soon as the arm is released, the coil causes it to swing back to its original position.

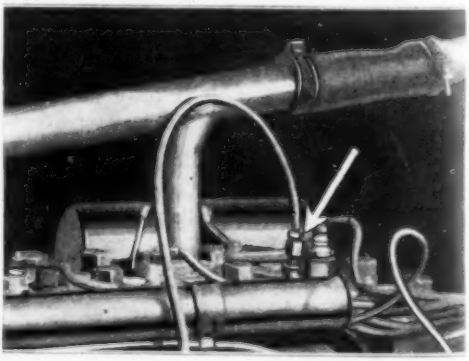
Growing Dahlias from Seed

Most people grow dahlias from roots, but they may be grown from seed without much additional trouble. The seed is planted indoors several weeks before the arrival of spring, and the young seedlings are transferred to pots when they are large enough to be handled. As soon as danger from frost is over, they are planted in their permanent places. With good culture, these dahlias will come into full bloom as quickly as those grown from roots. It is well to remember, however, that dahlias do not come true from seed, and that there is a tendency to revert to semi-double or single forms.

Preventing Spark Plugs from Fouling

Frequently the owner of an automobile or truck finds one or more cylinders of the engine persistently fouling the spark plugs. This condition is usually caused by a too rich mixture of gas in the offending cylinders. Many times it is impossible to adjust the carburetor to serve all cylinders alike because of the shape of the intake manifold. A spark plug fouls in a rich mixture because the electrodes, or points of the plug, become covered with wet gas; this gradually extends up along the porcelain and finally shorts the plug. Having this in mind, an arrangement was provided that caused a charge of hot exhaust gas to be taken in through the spark plug at every suction stroke of the piston. The hot fumes are drawn in around the points of the plug and this evaporates the wet gas that may have collected. In this way it prevents the spark plug from fouling, unless the porcelain cracks or the spark plug is shorted outside of the engine.

To make a spark plug that will not foul, get one with the proper thread to fit the cylinder and which has a priming cup attached. Remove the priming cup and the porcelain and cut a metal disk, about ⅛ in. thick, then press this into the open end of the plug body. Drill a hole in the center of this disk so that the center electrode will have the proper clearance all around. Now the disk becomes one electrode and the original center point the other. Next obtain a brass ball-check ell, having a ⅛-in. thread on one end and some sort of solderless coupling for copper tubing on the other. Screw this ell into the spark

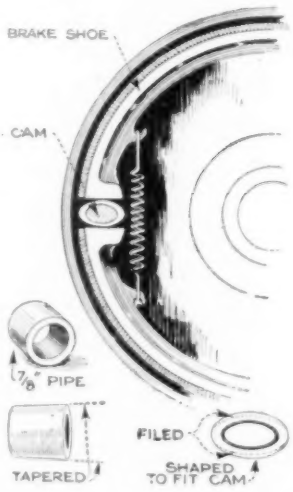


Simple Attachment That Prevents Spark Plugs from Fouling

plug in place of the priming cup. Put the spark plug in the cylinder that is giving trouble. Drill and tap a hole in the exhaust manifold, fit a small shut-off cock into this hole and connect it to the ell on the spark plug with a length of copper tubing. Start the engine and when it is warmed up, open the shut-off cock as much as possible and permit the engine to idle. In assembling the ball-check ell and plug be sure that the check is set so that it closes at each compression stroke. It will be found that an engine having one or more cylinders that get too rich a mixture will run better with this attachment and will give more power. The disk in the end of the plug causes the hot fumes to clean off the electrodes, and it also prevents the wet unexploded gas from getting up around the porcelain. This attachment has been found entirely satisfactory by several car owners. —Noble D. Gilkison, Kansas City, Mo.

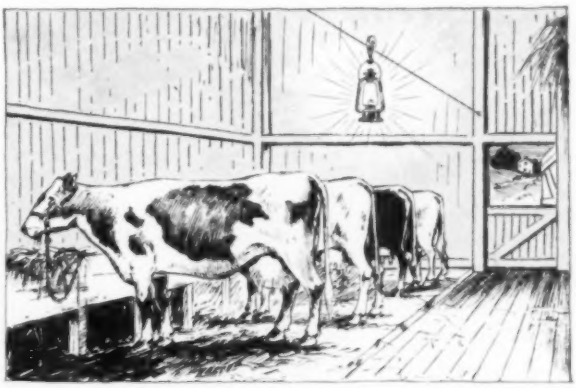
Expanding Brake Shoes

As the shoes of an expanding auto brake become worn and the toes of the operating cam wear off, the effect of turning the latter is lessened so that the brake has very little effect. The trouble can easily be remedied by driving a thimble on the cam to increase its size and this can be done without even removing it from the housing. A short nipple is cut from a length of suitable-diameter lap-welded pipe. The nipple is put on the point of an anvil horn and pounded to make it slightly conical in shape, and it is then flattened to fit the brake cam. The sides are filed or ground down until about half has been removed. It is then driven onto the cam, using shims if necessary for a snug fit.



Lantern Trolley for Dairy Barn

Better light distribution is obtained and the danger of fire in the dairy barn, due to upsetting of a lantern placed on the floor,

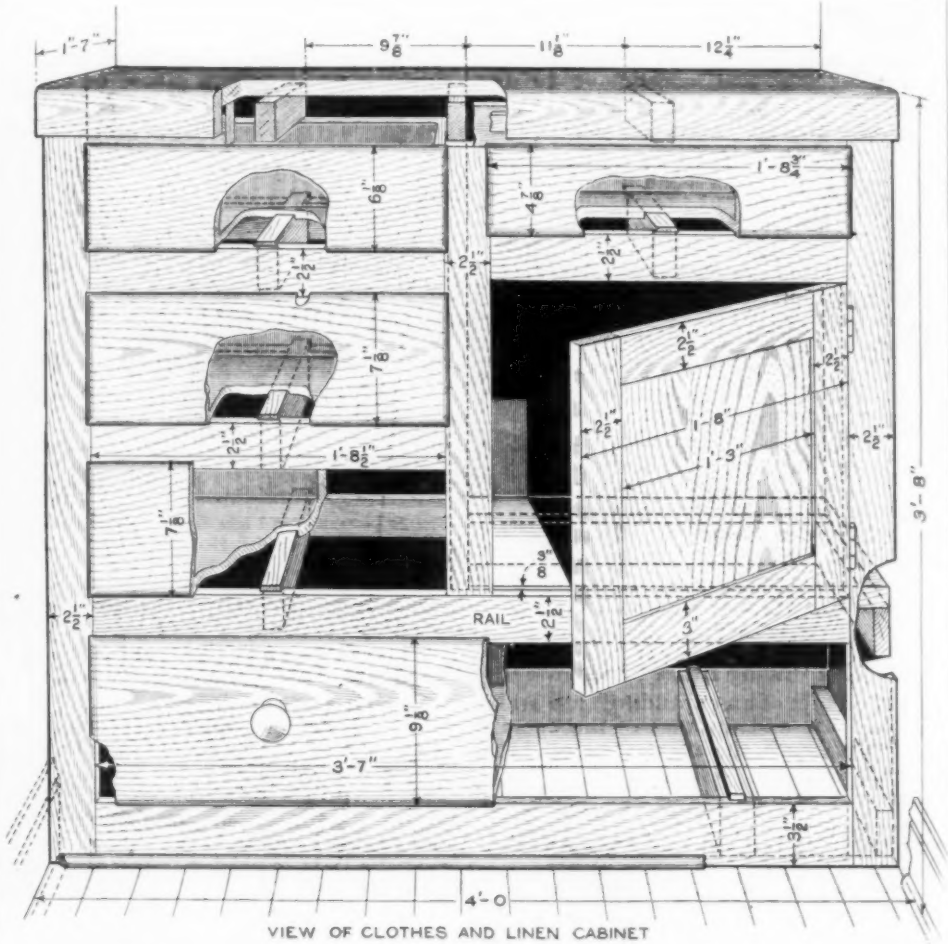


Danger of Fire Is Lessened and Light Is Distributed More Evenly by Hanging a Lantern on Wire Trolley

is lessened, if not entirely eliminated, by the arrangement shown in the drawing. A length of ordinary No. 14 galvanized-iron wire is stretched tightly across the barn, being securely fastened to studdings on opposite sides by means of large screw-eyes; an awning pulley to which a snap-hook is fastened is slipped over the wire before it is attached to the wall. The lantern is held by the snaphook so that there is no possibility of its falling, and it can readily be moved along the wire wherever the light is needed. Any slack in the wire can be taken up by driving the screw-eyes deeper into the studs.

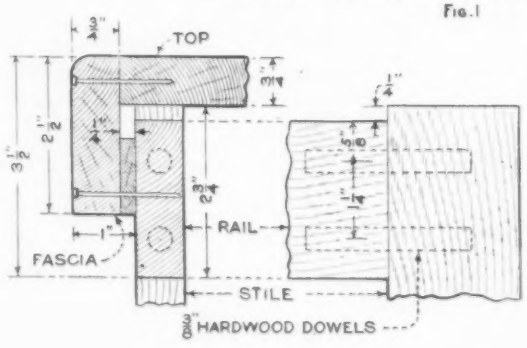
Putting a Shine on Windows

Clean and highly polished windows improve the appearance of any store front or home. A good method of doing this is to first wash them on the inside with lukewarm water applied with chamois skin without the use of any soap or other chemical. The outside of the windows should be cleaned with the following mixture: Pulverized whiting, 1 oz.; denatured grain alcohol, 1 oz.; liquid ammonia, 1 oz., and water, 1 pt. This solution is applied with a soft cloth, after the dirt has been removed. It is allowed to dry and is then rubbed off with a polishing motion, leaving the glass extremely brilliant. This method can be used with success on all kinds of windows, although, due to the smoothness of plate glass, a better effect can be produced on it than on ordinary house windows.



VIEW OF CLOTHES AND LINEN CABINET

FIG. 1

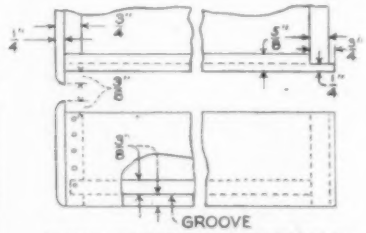


DETAIL OF FASCIA

FIG. 2

JOINT BETWEEN RAIL AND STILE

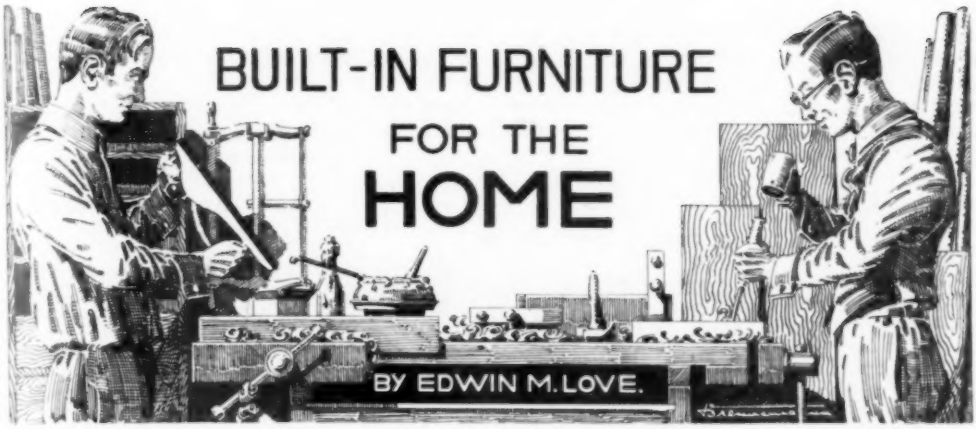
FIG. 3



DETAIL OF DRAWER CONSTRUCTION

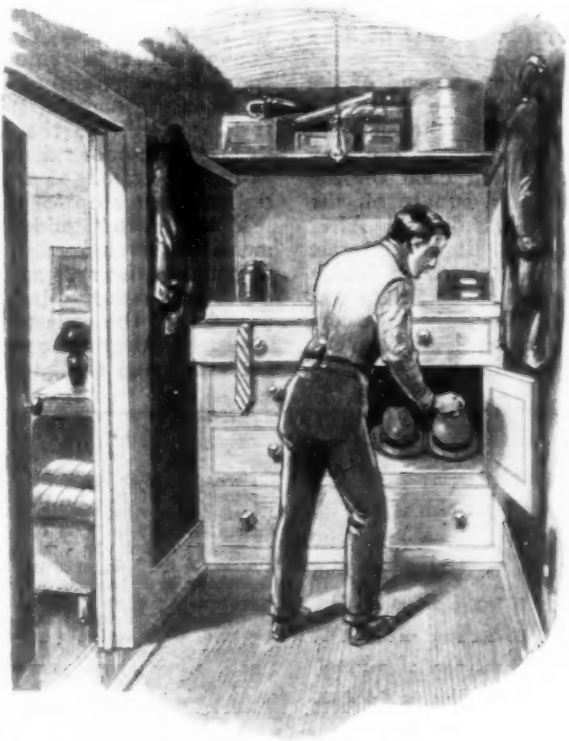
FIG. 4

Fig. 1, Assembly View of Closet, with General Dimensions; Fig. 2, Assembly of Fascia; Fig. 3, Detail of Rail and Stile Joints; Fig. 4, Constructional Details of Drawers



Part V—A Clothes-Closet Linen Cabinet

AN exceedingly useful addition to any fair-sized clothes closet is the simple cabinet illustrated herewith. The cupboard behind the door forms a dust-proof hat box, the large lower drawer a receptacle for shoes, and the other four drawers accommodate the overflow from the bureau in the bedroom. It is easily built, requiring about 20 hours, and if constructed of pine or fir, the material should cost no more than $8, making it very cheap. This particular cabinet was built at the end of a clothes closet which was 4 ft. wide from plaster to plaster, but by varying the width of the drawers it could be suited to a wider or narrower space, or with the use of a wooden end it would fit nicely in a corner against a side wall. Build the front frame out of 1⅛ by 3-in. stock, sized to 1 by 2½-in. net, except for the bottom rail, which is 3½ in. net in width. All stiles and rails are joined by two hardwood dowels, 3 in. long. Since dressing of the stock by hand, to remove imperfections, is likely to cause slight variations in width, it is well to label each piece when made, to eliminate trouble in assembling. In laying out for dowel holes, be sure to gauge always from the face side, as this will make the pieces come flush on the good side, regardless of variations in thickness. Glue up the top out of two widths of 1 by 10-in. pine, 4 ft. 1 in. long, either doweling them together or driving clamp nails (corrugated fasteners) in the back. The partition, of the same stock, is finished to a length of 2 ft. 6 in., and the shelf is left roughly to a length of 2 ft. 1 in. When the frame is dry, set it in position in the closet, leveling the rails and locating their levels on the



The Material for This Handy Clothes-Closet Cabinet Costs Only About $8, and the Work of Construction Requires Only a Few Hours' Time

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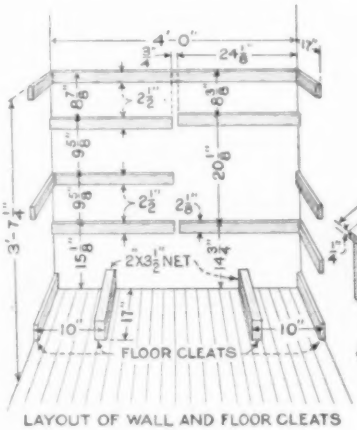
walls. Notice that, according to the dimensions, the outside stiles are ¼ in. higher than the upper rail, and these determine the height of the top cleats above the floor, that is, 3 ft. 7¼ in. Set aside the front frame, and level around the walls the lines corresponding to the tops of the cleats, and, using 1 by 3-in. stock, sized to 2½ in. in width, nail up the back cleats, as in Fig. 5, taking care that the ends of the short center cleats are plumb, since the edge of the partition for the hat box must slip in between. Plumb lines on the side walls, 17 in. from the back wall and nail three cleats on each wall, as shown in the detail, keeping the ends very accurately to the line. Also place the two heavy floor cleats of 2 by 4-in. stock, sized to 3½ in. net.



LAYOUT OF WALL AND FLOOR CLEATS
Fig. 5

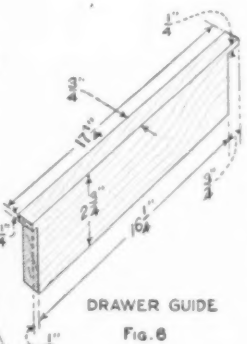


Fig. 6

Nail on a wall cleat for the end of the shelf, using stock 2⅛ in. wide (as is the back-shelf cleat) and scribe the end and back of the shelf to the walls. Plumb up from the end of the back cleat on the wall, place the shelf, and square off the free end from the line just drawn. After cutting, nail into place. It is advisable to put props under all cleats to which shelves are to be nailed so that they will not be driven down. Block the free corner to make the shelf level, and fit the partition so that, when in place, the top will be level and in line with the top cleat, while the front edge is plumb and in line with the front edge of the shelf and the front ends of the side cleats.

In setting the front frame, two methods are available, either to fit the edges snugly against the plaster, or to reduce the width enough to permit the frame to be forced into position, afterward covering the joint with a small quarter-round molding. The latter is more quickly and easily done than the former. If, however, it is desired to fit to the plaster, slip one edge of the frame into place and push the other stile back as far as it will go; and with a pair of compasses or dividers scribe down the stile. Repeat the process with the other stile, taking care that only enough stock is removed to permit the frame to slide tightly into place. Nail the stiles to the ends of the side cleats, and the lower rail to the floor cleats. Nail through the door rail into the shelf. The ⅜-in. projection of the shelf above the rail acts as a stop for the door.

Make drawer guides according to dimensions given in the detail, Fig. 6, and fit between the rails and wall cleats. The lower edges should be flush with the undersides of the rails to hold the drawers level when they are opened. Toenail into the rails from the back so that the nails

MATERIAL LIST

1 piece, 1⅛ by 3 in. by 16 ft., pine or fir, S4S, sanded.
1 piece, 1⅛ by 3 in. by 14 ft., pine or fir, S4S, sanded.
1 piece, 1⅛ by 4 in. by 6 ft., pine or fir, S4S, sanded.
1 piece, 1 by 10 in. by 8 ft., pine or fir, S4S, sanded.
1 piece, 1 by 10 in. by 10 ft., pine or fir, S4S, sanded.
1 piece, 1 by 3 in. by 14 ft., pine or fir, S4S, sanded.
1 piece, 1 by 3 in. by 16 ft., pine or fir, S4S, sanded.
1 piece, 2 by 4 in. by 3 ft., pine or fir, S4S, sanded.
1 piece, 1 by 7 in. by 4 ft., drawer front.
1 piece, 1 by 8 in. by 4 ft., drawer front.
1 piece, 1 by 10 in. by 4 ft., drawer front.
1 piece, ⅝ by 6 in. by 4 ft., drawer back.
1 piece, ⅝ by 7 in. by 4 ft., drawer back.
1 piece, ⅝ by 9 in. by 4 ft., drawer back.
1 piece, ⅝ by 7 in. by 6 ft., drawer side.
1 piece, ⅝ by 8 in. by 6 ft., drawer side.
1 piece, ⅝ by 10 in. by 6 ft., drawer side.
5 pieces, ⅜ by 6 by 10 ft., T & G pine drawer bottom, sanded.
7 1½-in. glass drawer pulls.
1 pair 2½ by 2½-in. loose-pin butts, to match door hinges.
½ lb. six-penny finish nails.
¼ lb. four-penny finish nails.
1 piece, ⅜ by 16 by 14 in., door panel.

will not show. Cut in the two top cleats, lining them with a straightedge, and fit the top.

For fitting, the top should be at least ½ in. too long, and more if the plaster corners are much out of square. Lay it in place, one end on its cleat, the other leaning against the opposite wall. Set the dividers for ¼ in. and scribe the low end to the wall. Cut off to the mark, beveling under to insure a tight fit on top. Measuring from this out, lay off the exact length of the finished top, and set the uncut end for scribing, this time setting the dividers to the point measured. When cut, slip into place and scribe against the back wall. Naturally the sliding back into place will shift the ends from the exact part of the walls to which they were scribed, but the distance is so slight that the fit should remain good. To get the front edge, allow a projection of ¼ in. beyond the stiles and upper rail. Joint carefully, replace and nail to the cleats and partition, and glue and nail on the fascia, which are made of 1 by 3-in. material sized to 2½ in. net in width and rounded off on the top corner, as detailed in Fig. 2.

Build the door next, to the dimensions in Fig. 1, so that it will be dry by the time the drawers are fitted. The stiles and upper rail are of 1⅛ by 2½-in. net stock, and the lower of material 3 in. wide net. Plow the inner edges ⅜ in. wide and ⅜ in. deep for the veneer panel, which is cut to a width of 1 ft. 3⅝ in. by 1 ft. 1⅛ in. in length.

In building the drawers, allow ⅛ in. in width for clearance and 1/16 in. in height, and leave a ⅜-in. lip, ¼ in. thick, on the top edge and ends of the fronts. Place the drawers individually and scribe on the bottom along each side of the guides, using the lines so obtained for the placing of thin strips on the bottom to form a track for the guide.

Surface the door to 11/16 in. in thickness. Fit it with a clearance of 1/16 in. all around, being careful to have enough bevel on the lock stile to clear easily, and line the hinges with the top and bottom rails, in such a way that they will project about ½ inch.

Do not put on the knobs and catches until the painting is complete.

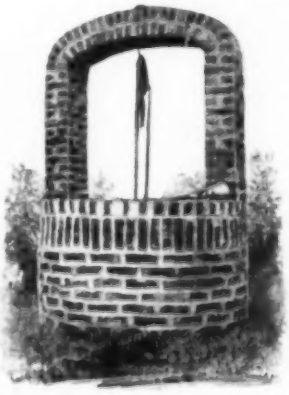
Old Tires Make Boat Fenders

Old automobile tires make splendid fenders for small boats. All that is necessary is to cut the tires into four pieces,

These Fenders, Made from Old Tires, Save One Owner $100 to $150 a Year

cut a 1¼-in. hole through one end of each piece for a rope and secure them to the sides of the boat. The iron bead is cut off the tire to prevent it from chafing the boat. To make the fenders more substantial, they can be made in two parts; by using pieces of small tires inside larger ones. I am a ship chandler, and use my boat in all kinds of rough weather, landing against the sides of large ships, and this simple idea saves me from $100 to $150 every year.—Capt. Claude Wynne, Norfolk, Va.

Ornamental Brick Well

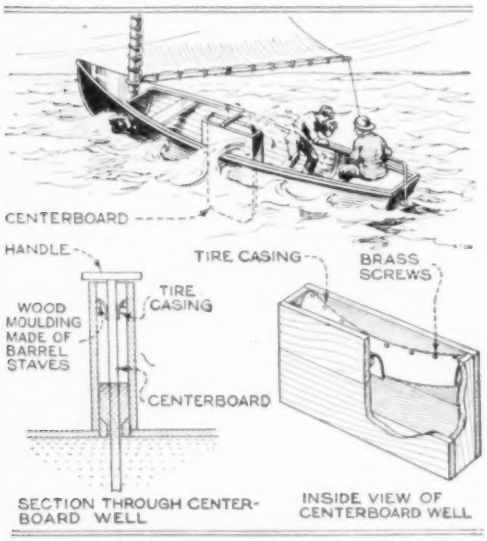


Disguised as an attractive brick well, which harmonizes with the material of the buildings, an old back-yard cistern is still in daily service. Two oak buckets are attached to the ends of the rope, which is suspended from the center of the arch as shown in the photo. When not in use, a wooden lid is placed over the top.—Lauree Osborn, Lincoln, Nebr.

¶ Automobiles can be kept looking new by varnishing them every six months.

Making Centerboard Well Splash-Proof

Almost every sailing enthusiast has experienced the annoyance of having water



Splash Guards Made from Auto Tire Make Centerboard Well Splash-Proof

squirt up through the centerboard well and drench the occupants of the boat. The usual method of prevention is to calk up the top of the well, but this has the disadvantage of making it impossible to withdraw the centerboard when necessary. One owner fixed his well in the manner shown in the drawing, so that not only was it impossible for water to come through, but the board could be taken out with ease.

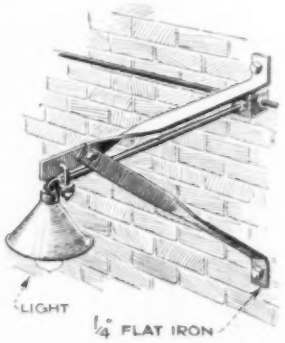
The boat was beached and the well taken apart; then to each side was screwed a length of 30 by 3½-in. tire casing, the casing first being split and the beads trimmed off. Under each strip was nailed a molding made from a barrel stave, as shown in the detail. Brass screws were used for attaching the casing to the sides of the well, and the edges were sealed with white lead. These splash guards are completely water-tight.

Bromide-Paper Negatives

While bromide paper, such as is used for making enlargements, does not possess the speed of a photographic plate or film, very interesting pictures of still subjects can be made with it; the results obtained approaching the vague, hazy quality so much sought after by those who use soft-focus lenses. To use bromide paper in this way, when working with a plate camera, it is only necessary to trim a sheet to the dimensions of the plate and, after sticking it to the glass side of an old negative with a tiny dab of paste at each corner, load in the plate holder in the usual way. For use in film cameras, the process is even simpler, for then a sheet of the paper, trimmed to the right size, can be laid over the opening in the rear of the camera, in the space usually occupied by the film. It is, of course, necessary to do the loading in a dark room by the light of a red or orange-colored light, and to take care that the sensitive side of the paper faces outward. While no definite rules for making the exposure can be given, it is safe to give at least twenty times as much exposure as when using films. This may seem excessively long, but when we consider that twenty times 1/25 of a second, is approximately one second, and that twenty times 1/5 of a second is four seconds, it is apparent that the exposures are not so long as one would at first suppose. After the paper has been exposed, develop, fix, wash, and then, before printing, rub vaseline into the back to render it translucent.—John D. Mayer, New York City.

Inexpensive Wall-Light Bracket

Where a number of exterior wall-light brackets must be used the cost of the fixtures is quite an item, being sometimes even more than the cost of the wiring. One building superintendent devised a type of bracket consisting of two lengths of ¼ by 1¼-in. flat iron, bent and riveted as shown in the illustration. This type is just as sturdy as any gooseneck fixture, and although not so neat-looking, serves the purpose just as well. It is attached to the wall with two lag screws and the conduit is brought directly from the junction box to the end of the bracket where it is held with a U-bolt, as shown. This type of bracket makes it possible to extend the lamps at practically any distance from the building and, in addition, the installation is waterproof.



RADIO

Loud Speaker and Amplifier for Crystal Set

THE owner of a crystal receiver who would like to use a loud speaker without going to a great deal of expense will find the instrument described in this article an ideal one for the purpose. It consists of a one-step amplifier built in the same cabinet with the base of a loud speaker, and will amplify local stations perfectly. The instrument shown in the accompanying illustrations was built in Popular Mechanics radio laboratory, and has given splendid results. It can be built by any fan at a very reasonable cost, and necessitates no change in the receiver. The terminals that are connected to the phones on the receiver are simply connected to a plug; that is all there is to change, and when the plug is shoved into the jack on the amplifier panel and the filament switch thrown on, the instrument is ready for operation. The first requirement is the cabinet. The one shown in the photo was picked up at

This Combined Amplifier and Loud Speaker Will Make the Crystal Set Operate like a Two-Tube Set on Local Stations; Above, Tuning In; Left, Rear View of Instrument, Showing Arrangement of Parts; Right, Front View of Completed Amplifier

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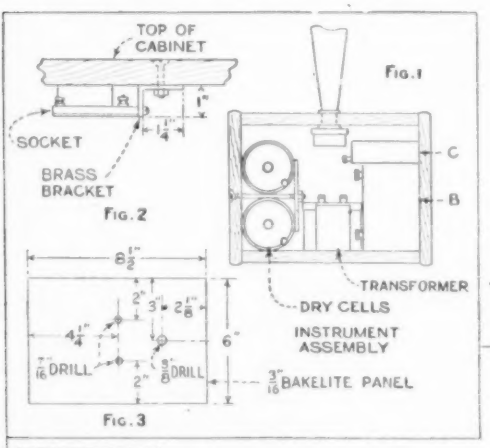
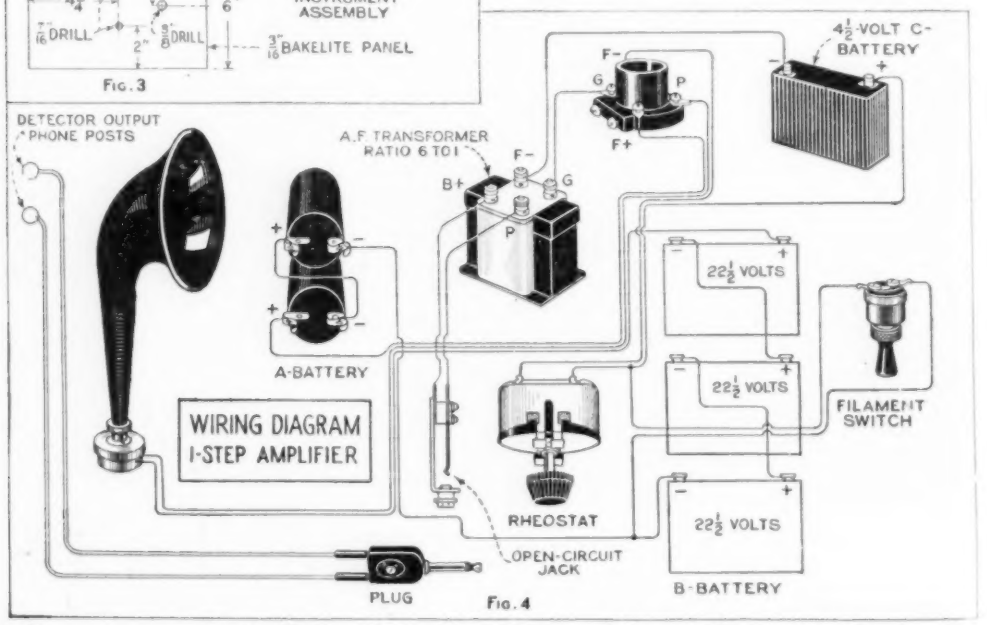
MATERIAL LIST

1 3-16 by 6 by 8½-in. panel.
1 tube socket for UV-199 or C-299 tube.
1 tube as above.
1 audio-frequency transformer, ratio 6 to 1.
1 filament switch.
1 open-circuit jack.
1 phone plug.
1 rheostat.
1 4½-volt C-battery.
3 22½-volt B-batteries, small type.
2 dry cells.
1 4-in. stove bolt.
1 ⅛ by ¾ by 4-in. sheet-metal strap.
1 small loud speaker with detachable unit.
1 brass angle, 2¼ in. long.
1 cabinet, 6 by 8½ by 7¾ in. inside dimensions.

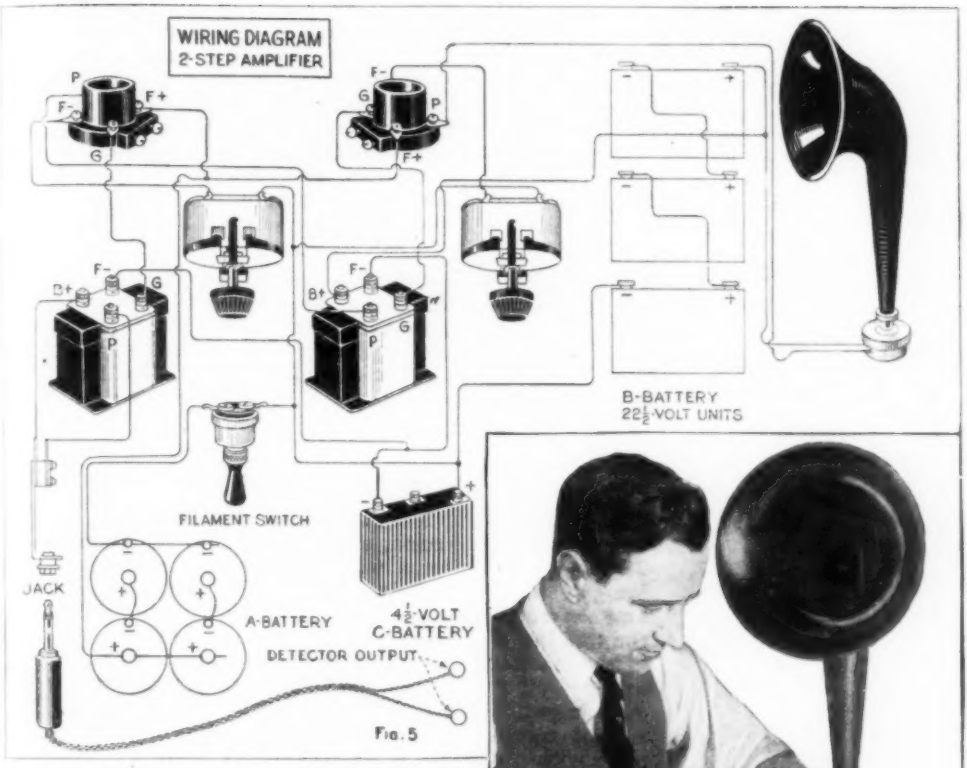
a radio store for a dollar, and the reader can probably pick up a similar one. The inside dimensions must be at least 6 in. high, 8½ in. wide and 7¾ in. deep, in order to accommodate the instruments. If a cabinet of this size is obtained, the layout of the panel will be as shown in Fig. 3; if not, the size of the panel will, of course, be different, but the position of the jack, rheostat and switch can remain the same. The arrangement of the instruments inside the cabinet is shown in Fig. 1. As a UV-199 or C-299 tube is used, two dry cells are mounted on one side of the cabinet, with the terminals toward the panel. These are held against the side of the cabinet by means of a metal strap and a stove bolt. Three small B-batteries are placed against the other side of the cabinet, with their terminals toward the center, and the 4½-volt C-battery lies on its side on top of these, its terminals also pointing inward. The B and C-batteries can be taped together if desired, so that they will not shift about.

The audio - frequency transformer, which has a ratio of 6 to 1, is screwed to the bottom of the cabinet, just under the horn, and far enough back so that it will not interfere with the jack when the panel is in place. Soldering lugs should be placed under all terminals on the batteries and the transformer before they are mounted in the cabinet.





Above, Panel Layout for One-Step Instrument, Mounting of Tube Socket and Arrangement of Components; Below, Wiring Diagram for One-Step Amplifier



Above, Wiring Diagram for Two-Step Amplifier; Below, Method of Soldering Leads to Instruments on Panel

Any type of horn can be used for the instrument. The base is unscrewed and the loud-speaker unit removed also; the latter is usually screwed to the bottom of the horn. Most loud-speaker horns have a small flange at the bottom that fits against the base, and the remainder of the horn tube, below this, is straight. Bore a hole in the rear of the cabinet top to fit this straight portion of the tube; the hole must be of such a size that the tube will fit tightly. Another hole is bored in the top of the cabinet, at the center and just in front of the horn hole, to clear the body of the tube. The tube socket is then mounted as shown in Fig. 2. The socket used in this instrument is of the panel-mounting type, with tapped holes in the side. A small brass angle is bent and drilled so that it can be bolted to the top of the cabinet by means of a flat-head machine screw and nut. The head of the screw can be colored to match the woodwork of the cabinet so that it will not be noticeable. A screw put through a hole drilled in the vertical leg of the angle bracket fastens the tube socket in place. The bracket should be so bent that the tube will come exactly in the center of the hole. This arrangement conserves space inside the cabinet, and allows easy access to the tube at all times.

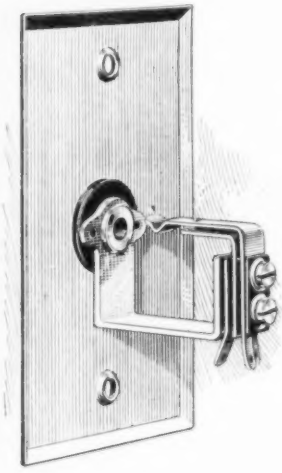
The loud-speaker unit can now be screwed onto the tube of the horn and the batteries hooked up. The reader should study the wiring diagrams carefully before making a single connection. Fig. 4 shows the wiring of the one-step amplifier as built in the laboratory. Fig. 5 shows the hook-up of a two-step amplifier; this can be built in a similar manner, except, of course, that a larger cabinet will be required.

Cut the cord from the horn unit to the proper length, and solder lugs to the ends. This conductor is usually tinsel, and care

Building a Two-Step Cockaday Receiver

must be taken when baring the ends. Solder the connections for the batteries to their lugs, then place the panel in the position shown in the photo accompanying Fig. 5, and solder the leads to the jack, rheostat and filament switch. Keep these leads long enough so that the panel can be removed at any time without disconnecting any leads. Put in the panel and back, and the instrument is ready for use. This instrument was tested, with a crystal receiver, against a standard two-tube receiver in the Popular Mechanics radio laboratory, and the results obtained with it were fully as good, on local stations, as those obtained with the tube set. The outfit can, of course, also be used as an amplifier on a tube set.

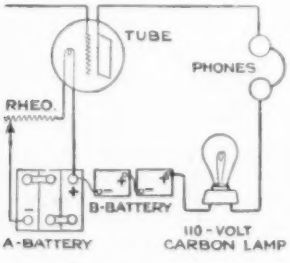
Aerial Jack Is Mounted in Wall Plate



A special jack for bringing in the aerial, mounted on an insulated brass escutcheon plate, is now available. This plate is 2¾ by 4½ in. long, and is screwed to the wall in the same manner as any other electric outlet. A neat nameplate with the word "Radio" completes the assembly. The wall jack is quite an improvement over the old methods of bringing in the aerial wire, and also automatically grounds the antenna, when the radio set is disconnected from the jack by removing the plug.

A Simple Tube Protector

Short-circuiting the B-battery through the tube filaments is an ever-present hazard that the radio enthusiast has to contend with. Often one will attempt to tighten a nut or move a wire with a screwdriver, pliers or other metal instrument, and accidentally short-circuit the B-battery through the tubes, with the result that new tubes will be needed at once. A simple way to guard against such an accident is to place a 110-volt carbon lamp in the circuit leading from the positive B-battery terminal to the phone post. This acts as a safety device, and any high voltage accidentally placed in the filament circuit of the tube is taken care of by the lamp.



Spring Posts for Quick Connections

Neat in design and quick and handy in action, a new binding post recently marketed will appeal to the radio fan. The post is made in two parts, connected by a spring, and fitted so that it cannot come apart. The lower part screws to the baseboard or terminal strip; the upper part has a hexagonal head with a hole drilled through it to take the wire. This is connected to the post simply by pulling the head upward and slipping the wire through the hole. Releasing the head locks the wire tightly and makes a good connection. To disconnect the wire, the head is pulled up and the wire drawn out. These operations can be done in a fraction of the time taken to describe them, thus making the job of hooking up a very fast one. In addition to this, as the head can be swiveled so that the hole faces in any direction, there is no need to be particular about how the posts are mounted on the base or strip. Another type, instead of the hole, has a slot in the side of the head, which in this case is pressed down until the slot lines up with another cut in the lower part of the post, when the wire or terminal can be slipped into place instantly.

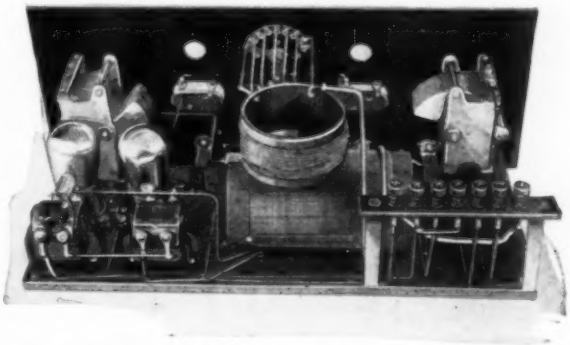
¶Cores of amplifying transformers should be grounded.

Building a Two-Step Cockaday Receiver

By F. L. BRITTIN

THE Cockaday circuit is highly selective, and all authorities agree that it is one of the best types of regenerative receivers. It is not difficult to build and with a little practice in tuning, the results are highly satisfactory. The instrument was built in Popular Mechanics radio laboratory, and the tests for selectivity left little to be desired.

The outstanding feature of this circuit is the arrangement of the four coils. They can be purchased in a complete unit and it hardly pays the builder to wind his own. The antenna loading coil consists of two bank-wound layers, having a total of 43 turns of No. 18 d.s.c. wire, tapped as shown in the diagram; this coil is mounted at right angles to the other coils. The taps are brought out to an inductance switch, so that the primary circuit can be tuned. The primary winding consists of one turn of heavy copper wire. This is wound over the smaller of the two lower coils, as shown in the circuit diagram. The smaller coil on the lower tube consists of 34 turns of No. 18 d.s.c. wire and the larger coil of 65 turns of the same wire. Both of the tubes have a diameter of 3¼ in. The panel is bakelite, radion, or formica, 3/16 by 7 by 18 in. in size. Lay out a template on heavy bristol board for this panel, marking the location of the various holes with a prick punch. Always drill the panel from front to back, so that the holes will be clean-cut. The size and position of the various holes will be noted in the drawing of the front panel. The two .0005-mfd. variable condensers are mounted at right and left of the panel, in such a position that the rotor plates of these condensers will be toward the center of the panel; this is shown in the wiring diagram. The rheostats are of the carbon-pile type and are mounted through a single hole on the panel, in the position shown. The inductance switch is self-contained, and is mounted on the back of the panel with a single pole, eliminating the necessity of switch points on the front of the panel. This is a nine-point switch, but only seven of the taps are used. Directly below the inductance switch, the push-pull filament switch is located. The holes above the rheostats are merely for viewing the brilliancy of the tubes, and also provide a means for air to circulate over the set. The jacks are placed at the lower edge of the panel in the position shown. The detector and first-step amplifier jacks are of the double-circuit type, and the second amplifier jack of the open-circuit type. This completes the front panel.



Rear of Cockaday Receiver; Note How the Coil Is Arranged So That the Leads to the Switch Are Straight and Direct

The baseboard is ½ by 6¾ by 17 in. in dimensions, and the instruments are mounted on it in the position shown in the wiring diagram. The coil unit is located toward the rear, with the taps on the upper coil directly opposite those on the inductance switch. The detector-tube socket, grid leak and grid condenser are placed in front of the coil unit. Directly back, and to the right of the coil, two 4-in. brass brackets support a 3/16 by ¾ by 7-in. bakelite strip on which the terminal posts are mounted. Seven binding posts are used; these posts can be obtained with engraved tops, or the strip itself can be engraved, as

View of Front of Finished Two-Step Cockaday Receiver, Showing Arrangement of Panel

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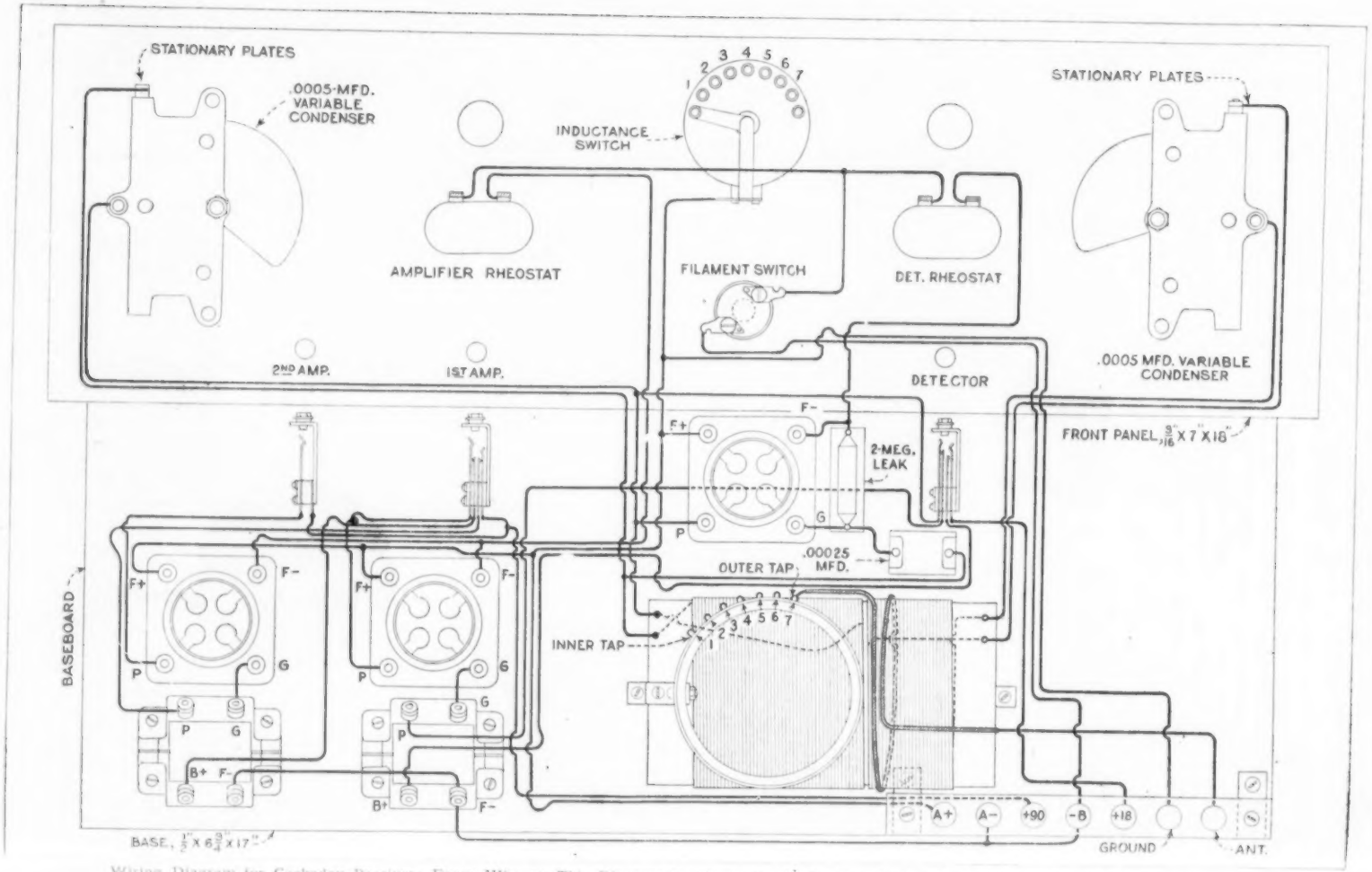
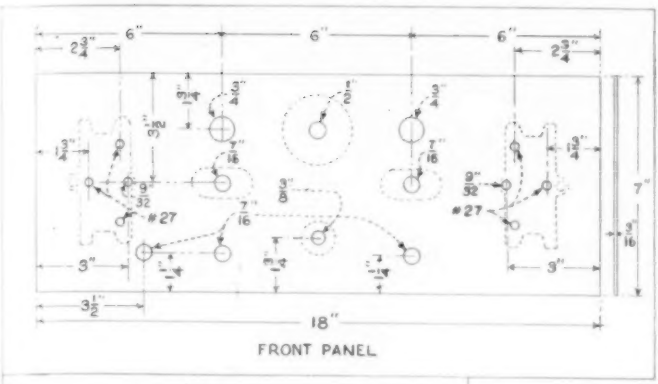
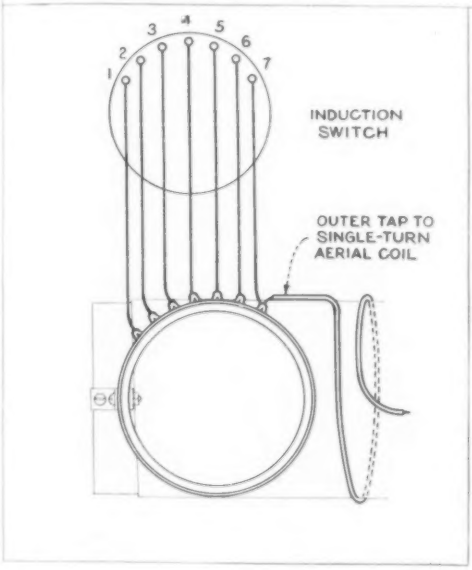


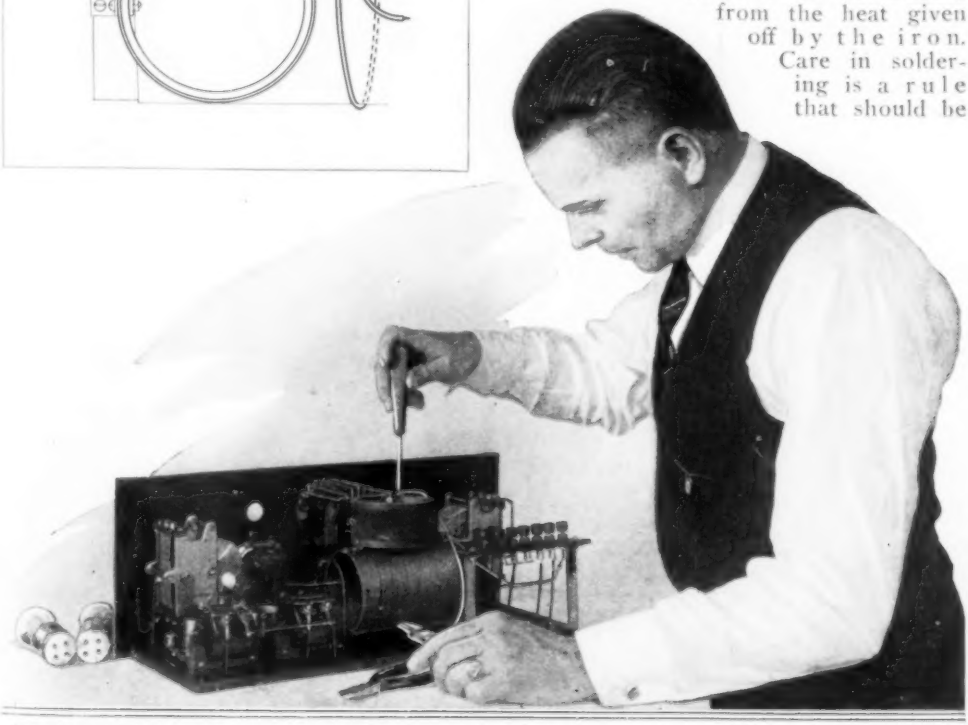
Wiring Diagram for Cockaday Receiver; Every Wire on This Diagram Is Shown in the Position It Should Occupy on the Finished Instrument



FRONT PANEL



desired. The sockets for the amplifying tubes and the audio-frequency transformers are mounted at the left of the baseboard, as shown in the diagram. The panel is then mounted on the baseboard with three nickelplated oval-head wood screws, driven into the edge of the board through holes drilled in the panel. The instrument is now ready to be wired. Use No. 14 round tinned-copper wire for this purpose, and cover it with a good grade of black spaghetti tubing. Use solid-wire solder and some good soldering paste; the latter should be used very sparingly, applying a minute amount to the wire and lug to be soldered and then wiping it off. The paste is intended to clean the surface rather than to act as a flux. An inexpensive electric soldering iron is a very handy instrument around the home and almost indispensable to the radio builder. Soldering lugs are used under the terminals of all the instruments to be connected in the circuit. These lugs protect the instruments from the heat given off by the iron. Care in soldering is a rule that should be



Top, Template for Panel; Center, Connecting Wires from Upper Coil to Switch; Below, Assembling the Set

Tools That Aid in Building Sets

ever-present in the mind of the radio builder.

Cut the wire for the circuit, after bending it to the proper shape, to make the connections from instrument to instrument as direct as possible, taking care not to make any of the grid or plate leads parallel. Where it is necessary to cross these leads, do so at right angles. The reader will note that the grid leak has its individual mounting, owing to the fact that the leak is not used in the usual manner across the grid condenser. The usual grid condenser with the grid-leak clips is, therefore, not used. Soldering lugs are secured to the .00025-mfd. grid condenser by means of two short brass machine screws and hexagon nuts. Never attempt to solder a lead directly to the fixed condenser, as the heat from the iron will ruin it. The safest method is to solder the lugs to the wire first and then attach the lugs to the condenser with the screws. Do not solder the leads to the inductance switch until all other wiring has been completed. Examine the terminals from the upper and lower coils of the coil unit and see that they correspond with the diagram, and follow the leads from the ends of the coils so that the connections to the circuit are the same as those shown in the circuit diagram.

The circuit is now completed and the builder should retrace all of the leads and check them carefully. The single turn of heavy copper wire should fit closely to the end coil on the lower tube and can be adjusted for best results when the set is in operation. The receiver should then be tested.

Connect all A and B-batteries before putting the tubes in the sockets, and also the aerial and ground. Use an ordinary outside aerial, from 75 to 100 ft. long, and a good ground to a cold-water pipe. A UV-200 or C-300 tube is used for the detector and two UV-201A or C-301A tubes for the amplifiers. To tune the instrument, place the inductance-switch lever on any point and rotate the condenser dials slowly until a station is located. If no station is located at this setting, move the inductance switch one point, and rotate the condenser dials as before. Some detector tubes give better results with a 3-megohm grid leak than with the 2-megohm, and it is a good idea to try both. The phones plugged into the detector jack will give sufficient volume on local stations; on more distant stations the first step of amplification will be required with the phones. The second step is for operating the horn or loud speaker, and the volume is too great at this stage to permit the use of the headphones. When selecting the parts to build this receiver, buy the best, as the best is always the most economical in the long run, and this applies to any type of radio receiver. A 7 by 18-in. cabinet can be obtained from any dealer in radio supplies, and the appearance of the panel can be improved by engraving it to suit the needs of the builder. The reader will note in the photo of the finished receiver that special vernier dials were used. These dials are not absolutely necessary, but they do aid in the tuning of the instrument because they afford a means of very fine control of the condenser.

MATERIAL LIST

1 precision Cockaday coil.
1 bakelite, radion or formica panel, 3-16 by 7 by 18 in.
2 audio-frequency transformers, ratio 3 to 1.
3 sockets, standard type.
1 filament switch, push-pull type.
2 rheostats, 6-ohm.
1 back panel-mounting inductance switch, 9-point.
2 variable condensers, .0005-mfd. capacity.
1 open-circuit jack.
2 double-circuit jacks.
1 grid leak mounting.
1 grid leak, 2 megohm.
1 grid condenser, .00025 mfd.
10 ft. black spaghetti tubing.
1 lb. coil No. 14 tinned-copper wire.
3 doz. tinned-copper soldering lugs.
1 baseboard, ½ by 6¾ by 17 in.
2 3-in. dials.
7 binding posts.
1 strip of bakelite, 3-16 by ¾ by 7 in.
2 brass brackets, 4 in. long.
1 UV-200 or C-300 tube.
2 UV-201A or C-301A tubes.
2 45-volt B-battery units.
1 6-volt storage battery.

Aerial Insulator of Special Glass Is Efficient and Clean

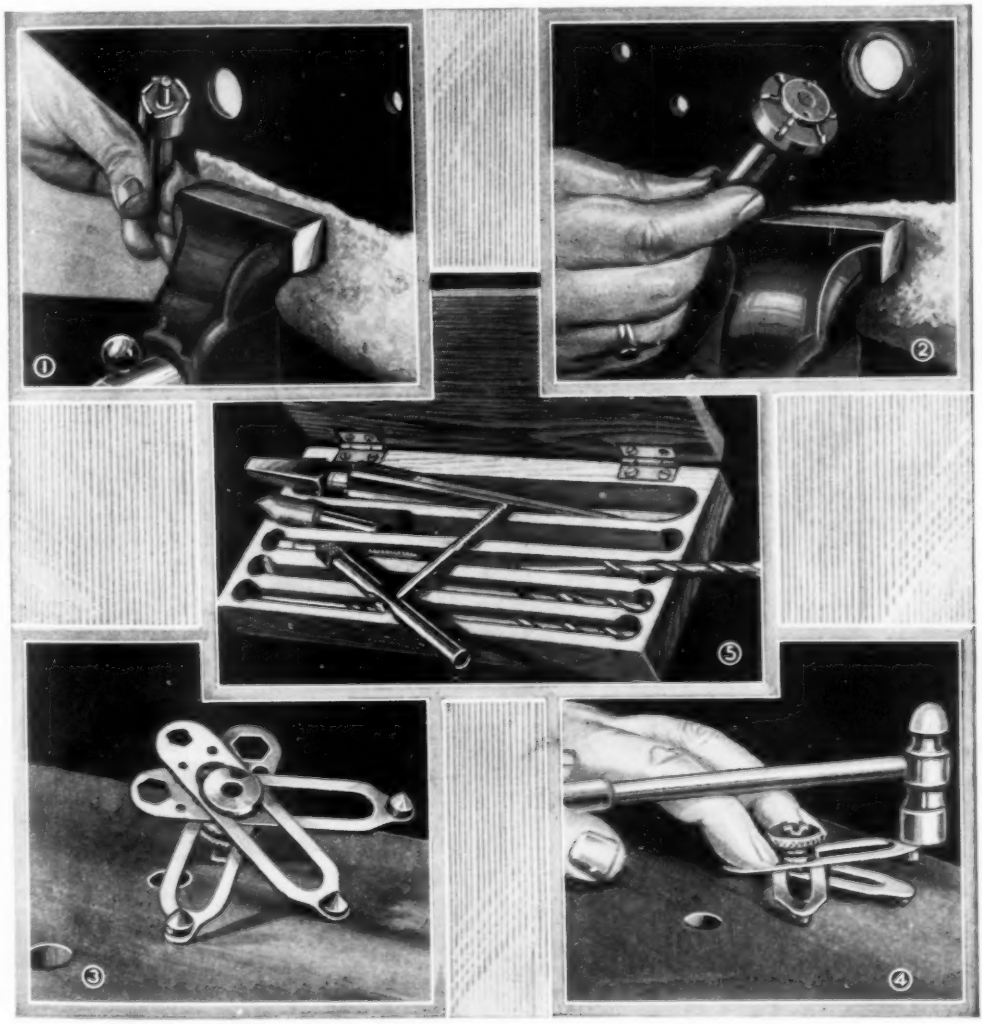
A special pyrex glass insulator for aerials with a high surface finish that does not tend to accumulate soot and atmospheric dust has lately appeared on the market. The insulator has very high insulating properties, and does not absorb moisture. These insulators are made in three types, for commercial transmission, for amateur transmission, and a smaller type for broadcast reception. All three types possess the same characteristics, the difference being in size only.

Tools That Aid in Building Sets

SET building is a pleasure when the proper tools are used, but when the amateur attempts to build a set with a screwdriver, a pair of pliers and an ice pick, he is apt to run into difficulties. Not that the last-mentioned tool isn't useful—it is—but the job is so much easier with the tools that have been developed to help the radio fan in his work, that he should be familiar with them.

Two excellent tools are shown in Figs. 1 and 2. The first is a cutter for making peepholes in panels. It is made in three sizes, ¾, 1 and 1½ in. in diameter. All are fitted with 3/16-in. pilots, and all that is necessary is to drill a hole of this size at the proper location on the panel, put the cutter in a brace, insert the pilot in the small hole and proceed to cut out the hole. The larger sizes are useful for cutting holes in the subpanel for tube sockets. Fig. 2 shows a tool that will put a professional finish on the peephole. It is made in two sizes, ¾ and 1 in., to suit the cutters mentioned above. The beader, as the tool is called, finishes the edge of the hole as shown in the photo.

In Figs. 3 and 4 is shown a tool that will appeal to every builder who has tried to lay out the holes for a condenser or other part without a template. The three arms can be adjusted so that the points fit the mounting holes in the instrument. The shaft of the latter is put through its



Clever Tools for the Radio Builder That Aid in Drilling and Finishing Peepholes and Socket Holes; Drilling and Tapping Panels, and Marking Off for Various Instruments

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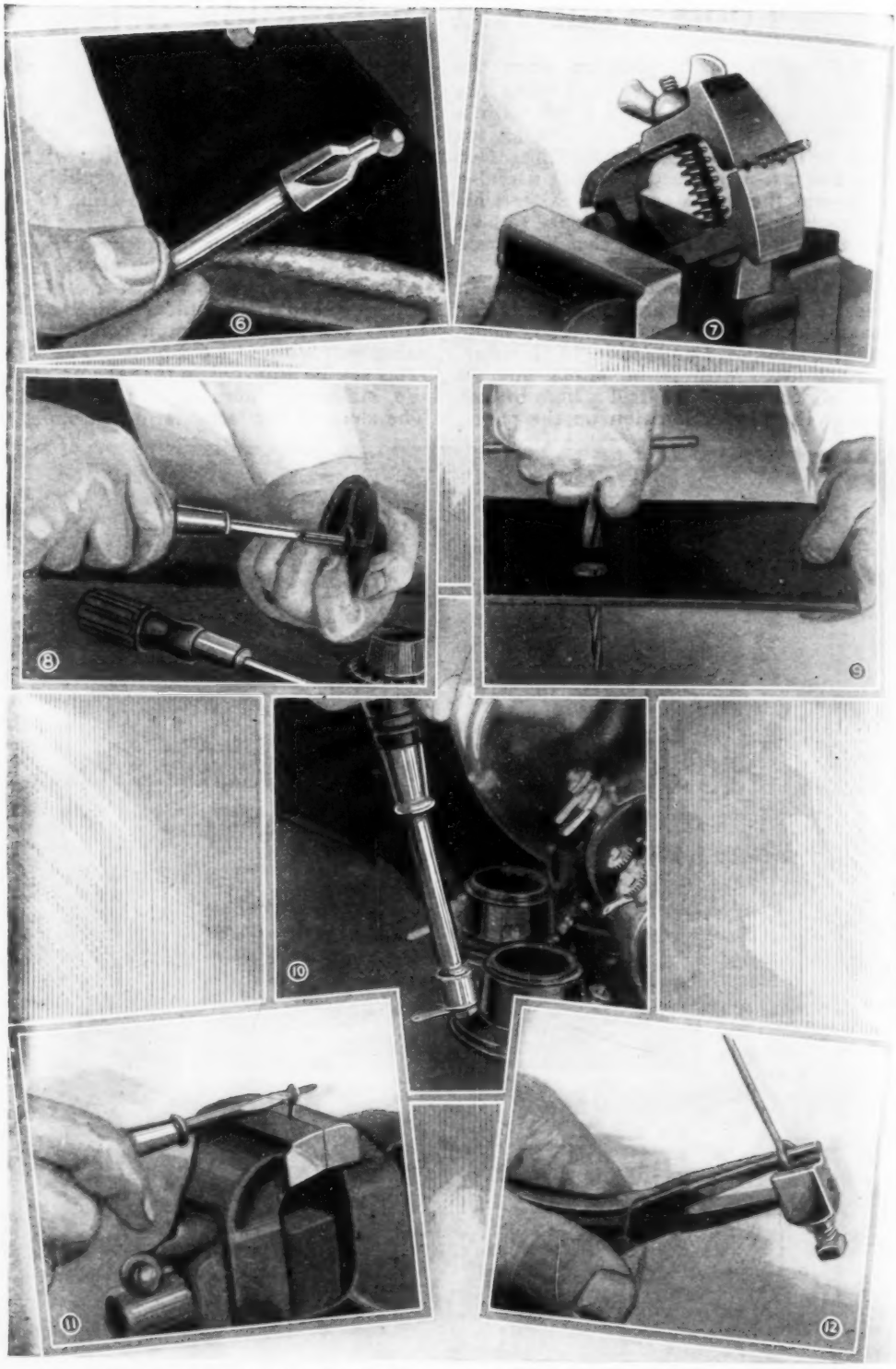


Tools for Drilling and Countersinking in One Operation; for Holding Screws to Be Cut to Length; Reaming Dials and Panels; Tightening Socket and Similar Screws; Reaming Small Work to Size; Bending Loops and Special Forms in Wire, and Many Other Operations

A Selective Crystal Receiver

hole, the tool slipped over it, and, with three taps of the hammer, the holes are marked exactly. The arms also have holes that serve to gauge drills for clearing holes for various sizes of taps and the tapping sizes. Hexagonal holes in the ends of the arms form convenient wrenches for various standard nuts on radio instruments. A convenient screw plate is shown in Fig. 5. The set contains No. 6-32 and 8-32 taps, tapping and clearing drills for these sizes, a small tap holder, a countersink to fit flat and oval-head screws, and a taper reamer, and will prove a worth-while addition to the tool kit.

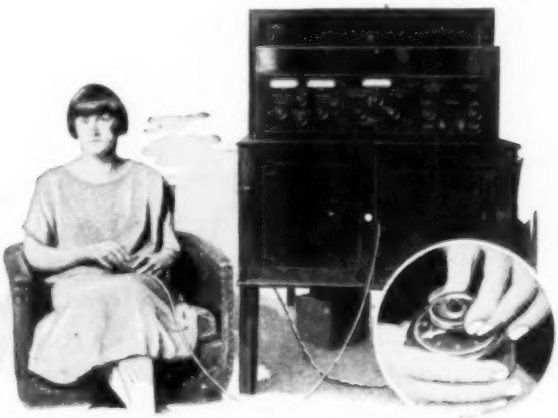
A tool that drills a hole for a No. 6-32 machine screw and countersinks it in one operation is shown in Fig. 6. The tool shown in Fig. 7 will appeal to the fan who has ever tried to cut off a small screw that was too long for his purpose. It is a small vise with three tapped holes in the jaws. The screw to be cut or filed is held in the proper hole and cannot slip or be marred in any way. It fits No. 6, 8 and 10 screws, 32-thread, and the hardened jaws may be used as rethreading dies, if necessary. Figs. 8 and 9 show tools for which there is constant use. The first is a small parallel reamer that is used to clear out holes in dials to the proper size for the instrument shafts, and also to ream holes in jacks that are too tight for the plugs. The second is a taper reamer with a helical cutting edge that produces a true round hole in metal, bakelite, hard rubber, wood, etc., without digging in or chattering. A reamer of this type should be in the kit of every radio builder.

It is quite a job, in many sets, to tighten or loosen the binding-post nuts on transformers, tube sockets and other instruments. If pliers are used they are apt to slip and mar the nuts and, besides, the instruments are many times mounted in such a position that the pliers cannot be applied. In such cases the socket wrench shown in Fig. 10 will prove of value. This is made like a screwdriver, and the sharp teeth of the socket are spiraled and tapered so that they take a firm grip on the round nuts. They are made in three sizes to take all types of round radio nuts.

Another simple, but very handy reamer is shown in Fig. 11. This is square in shape and tapered so as to form four cutting edges. It can be used for reaming holes in lugs and washers, starting screws in hardwood, and as a scriber, to mention only a few of its possibilities. Equally handy is the attachment shown in Fig. 12. This is a little tool intended for forming loops on busbar and similar wires. In use, it is simply slipped over one jaw of a pair of round-nose pliers, and it will form eyes of any desired size in the wire. It will also bend special forms in the wiring of the set quickly and easily.

Radio Receiver Has Remote Control

A receiver with remote control has made its appearance in England. This arrangement permits the operator to control the volume of the loud speaker while seated at a distance from the instrument. A flexible cord leads from the set to the control device, which is held in the operator's hand; by turning a knob the volume of sound can be increased or decreased. The device consists of a rheostat which controls the filament of the detector tube, no other rheostat being used on this tube, and the control unit at the same time actuates a relay, inside of the receiver, which completes the circuit to the other tubes. The receiver has seven tubes and uses three steps of radio-frequency, detector and three steps of audio-frequency amplification. As soon as the lever of the device is moved from the zero position, it completes the circuit to all the seven tubes and when further rotated increases the filament current to the detector tube only. The other six tubes are controlled by separate rheostats, after the circuit is completed.

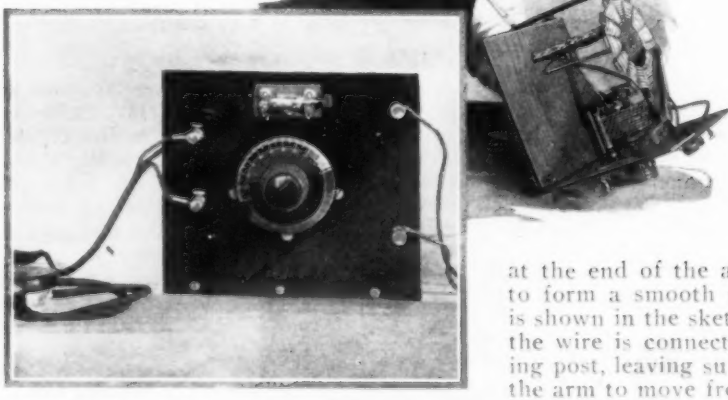


Remote Control Permits Adjustments from Any Part of Room; Insert, Control Unit

A Selective Crystal Receiver

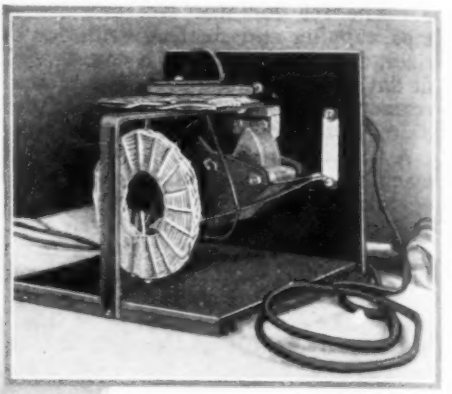
By WILL H. BATES

THE crystal receiver described in this article can be built for less than $5, not including the cost of the phones. A good pair of 2,000-ohm phones, however, can be obtained for from $3 up. This circuit gives excellent volume and has exceptional selectivity. The lack of selectivity in ordinary crystal receivers is well known to those who have built them, and this circuit is an agreeable surprise. During the test, in Popular Mechanics laboratory, this little set demonstrated its ability to tune out any of the Chicago stations at will. This is unusual, and offers a basis for further experimentation. When used with the one-tube amplifier and loud-speaker unit described and illustrated in the first article in this section, the volume on local stations was sufficient to fill a large room. The panel can be of any insulating material and is 3/16 by 7 by 8 in. in size. The center of the panel is drilled to receive



Above, Rear View of Completed Set, Showing How the Coils Are Mounted; Below, Front View of Set

the shaft of the 21-plate variable condenser, the screws of the crystal detector, and the binding posts for the phones, aerial and ground. The baseboard is 1/8 by 8 by 8 in., and is fastened to the panel by means of three oval-head wood screws. A brass strip, 1/8 by 5/8 in., is used to mount the upper coil and also strengthens the panel and baseboard assembly; this strip is drilled at each end for the mounting screws. One end is screwed to the baseboard and the other to a small wood block fastened to the back of the panel, at a point just at the rear of the crystal detector. The block is fastened to the panel of the detector-mounting screws, and the brass strip is screwed to the block.



A wiper arm is mounted on the brass strip just in front of this block; the arm consists of a tapered strip of wood, 3/16 in. thick by 3 1/4 in. long. A hole is drilled in the small end and another near the front to permit a short length of No. 18 insulated wire to be threaded through the arm. The wire is bared at the end of the arm and doubled over to form a smooth wiping contact. This is shown in the sketch. The other end of the wire is connected to the aerial binding post, leaving sufficient slack to permit the arm to move freely. A hole is drilled in the front end of the arm and the assembly mounted on the brass strip by means of a small brass machine screw and two fiber washers; a locknut is placed on the mounting screw. This method of mounting the arm permits the wiper contact to be moved across the wires of the coil.

The coils are homemade, the upper coil being wound on a fiber form, 4 1/2 in. in diameter. This form can be cut from heavy cardboard if desired. No. 22 cotton-covered wire is used for this coil and 60 turns are wound on the form. Leave a

6 or 8-in. length of wire, when starting to wind the coil, and wind the wire over and under each segment of the form. The finishing end of the wire is fastened to the outer edge of the form by passing it through a small hole. The coil is then mounted on the strip by means of a small brass machine screw and fiber washer, in the position shown in the photo. The insulation is then bared across one arm of the coil for the wiper arm.

The lower coils are wound on a different type of form, and in a slightly different manner. The method of winding these coils will be seen in the illustration. A large wooden spool is used, the spool is cut in half, and the flange is drilled to take 19 twelve-penny nails, the holes being just large enough to take the ends of the nails snugly. Both of the lower coils are wound on this form and No. 22 cotton-covered wire is again used. The 10-turn coil is wound on the form first; be sure to leave an end several inches long on starting the coil, then wind the wire on clockwise, running it under two nails, then over two, and so on. After the 10 turns are wound, leave an end 8 or 10 in. long and cut the wire. The second coil of 60 turns is then wound in the same direction on the same form, leaving a starting end of the same length as before. After the 60 turns are completed, cut the wire, leaving a loose end several inches in length. Now press the coils firmly together on the nails, and carefully remove all of the latter. Lay the coils flat on a table, and with a large darning needle, threaded with heavy white cotton thread, bind the coils together. This is done by running the needle through each section of the coil, bringing the loop of thread to the top, cutting it off, tying a knot in the thread, and clipping off the ends. This holds the coils in position. The finished coil has a neat appearance, and is fairly strong.

A small wooden dowel pin of the same diameter as the nails is used to hold these coils upright on the baseboard, under the upper coil. The wooden pin is fitted in a hole in the baseboard, and the coil is mounted on the pin. The position of the lower coils is shown clearly in the photo of the completed set. The .0025-mfd. fixed condenser is then mounted on the back of the panel across the phone binding posts, and the set is ready to wire.

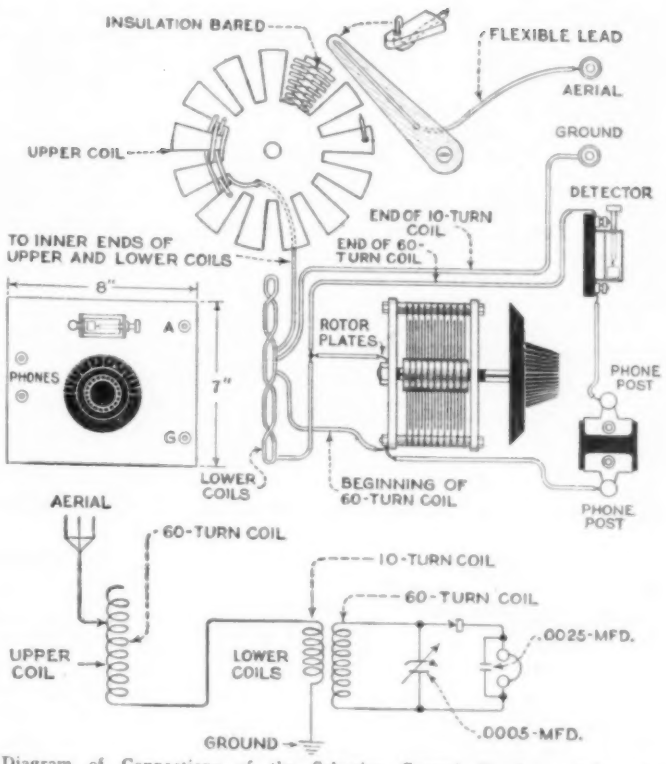
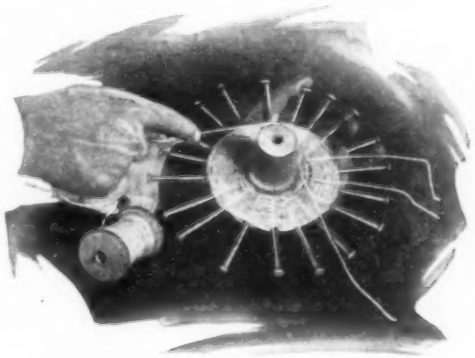


Diagram of Connections of the Selective Crystal Receiver; Schematic Diagram and Panel Template



Method of Winding Lower Coils on Form; the Nails Are Removable

The first turn of the upper coil is connected to the first turn of the 10-turn coil below. The other end of the 10-turn coil is connected to the ground binding post. The first turn of the lower 60-turn coil is taken to the stationary plates of the variable condenser and also to the phone post. The end of this coil is connected to the rotor plates of the variable condenser, and to the catwhisker of the crystal detector. The other side of the detector is connected to the remaining phone post, and the set is ready for operation.

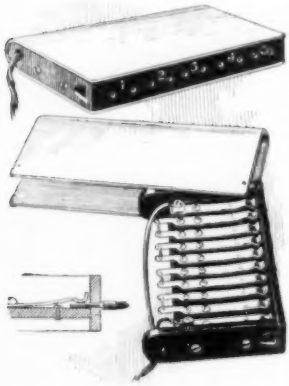
To operate, use an ordinary outside aerial and a good ground to a water pipe. Connect a pair of 2,000-ohm phones to the phone posts. The stations are located by moving the wiper arm across the upper coil, and tuning in the station with the variable condenser.

The following materials are needed:

1 bakelite panel, 3-16 by 7 by 8 in.
1 baseboard, ¾ by 8 by 8 in.
1 brass strip, ⅛ by ⅝ by 15 in.
½ lb. No. 22 cotton-covered wire.
1 crystal detector, panel-mounting type.
1 .0005-mfd. variable condenser.
1 3-in. dial.
1 .0025-mfd. fixed condenser.
4 binding posts.
1 fiber disk or spider-coil mounting, 4½ in. in diameter.
1 large spool.
19 twelve-penny nails.

Automatic Radio "Switchboard"

A new automatic switchblock, that provides series connections for five sets of headphones, is now available. Two terminals in the switchblock are connected to the plug or phone-post leads from the receiver, and the tips of the headset are inserted into the jacks. The two jacks for each set of phones are indicated by numbers on the block. Headsets can be connected or removed at will, and the action of the switches automatically keeps up the series connection. The block is fitted with a heavy aluminum cover. It is claimed that five sets of phones can be used with very slight reduction in the volume of reception. The terminals of the switchboard permit any type of cord tips or bare wire ends to be connected.



Hot Iron Shorts Fixed Condensers

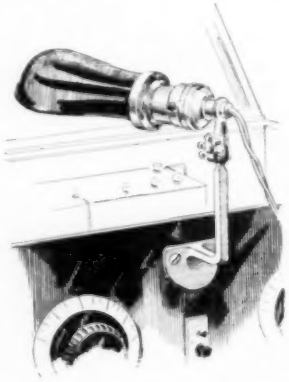
A common source of trouble encountered by the radio experimenter lies in short-circuited fixed condensers. As a rule trouble shooting in a receiver begins at the larger instruments, such as the transformers, variable condensers, tube sockets, and jacks. Much time can be saved by first examining the fixed condensers. These are very delicate and will not stand excessive heat from the soldering iron. If lugs are not provided with the condenser they should be supplied by the builder, and the connecting wires soldered to the lugs. Use short 6-32 machine screws for attaching the lugs to the condensers.

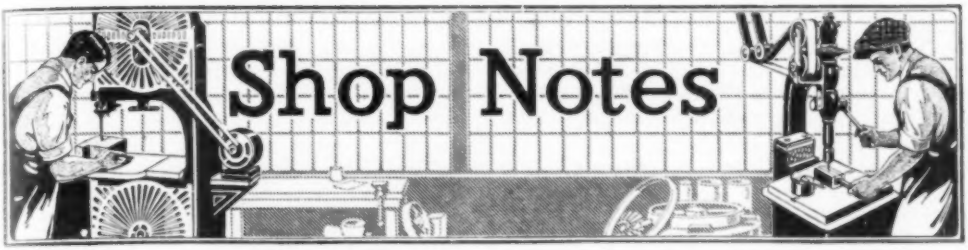
"Spaghetti" in Liquid Form

Put on with a brush like paint, a new liquid "spaghetti" dries quickly and forms an excellent insulation. It has been found well adapted for covering soldered joints to prevent corrosion, and is also claimed to be superior to varnished-cambric tubing for covering wires, as it prevents condensation on the wire and does not deteriorate with age. It can be used for cementing wire in forms, and for coloring small electric lamps.

Portable Lamp Illuminates Radio Set

A portable lamp that can be quickly attached to any radio set, eliminating all shadows and glare, is now available. Exact dial settings are somewhat difficult with ordinary room lighting, and this little lamp is therefore a welcome addition to the modern radio receiver. The ball joint affords easy adjustment and permits the operator to turn the lamp so as to illuminate the interior of the set if he desires. The small thumbnut allows the light fixture to be detached.





All Shop Notes published in 1924, in book form—Fifty Cents—from our Book Department

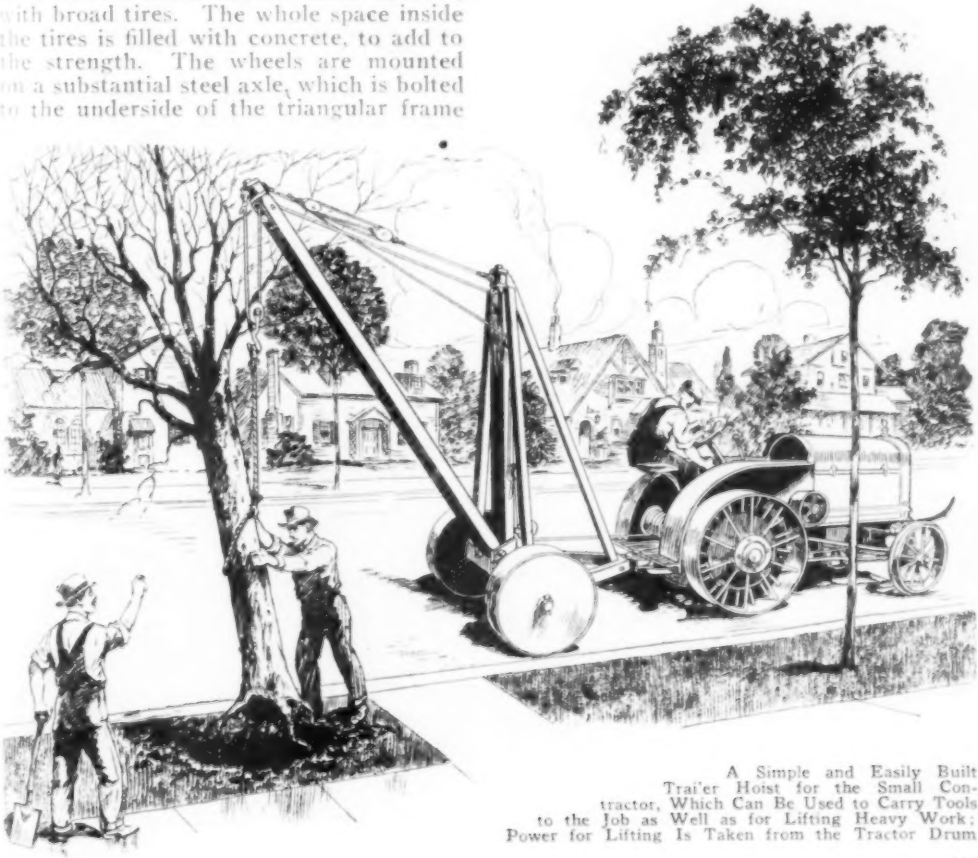
Trailer Hoist for Contractors

By G. A. LUERS

THE trailer hoist described in this article has been built by an eastern contractor, who uses it for two purposes. Attached to the rear of a tractor, the base affords a small trailer on which materials may be carried to and from the job; once at the place where the work is to be done, the load is removed, and the hoist is available for work.

The wheels were taken from an old horse-drawn truck and are made of steel, with broad tires. The whole space inside the tires is filled with concrete, to add to the strength. The wheels are mounted on a substantial steel axle, which is bolted to the underside of the triangular frame of the trailer. The rear member of this frame, to which the axle is bolted, is built up of flat steel, and the front members are also bolted to it; the latter are made of wood, as indicated in the drawings, and are fitted with a simple coupling, so that the trailer may be attached to the drawbar of the tractor by means of a pin.

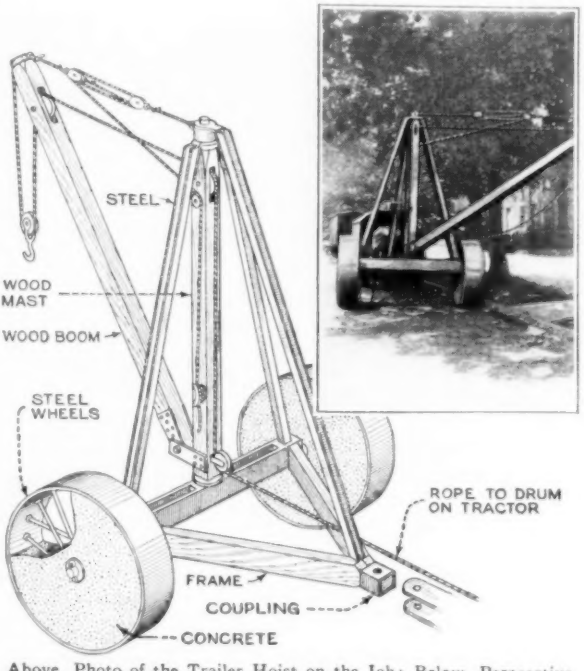
The wooden mast is pivoted on a steel plate at the center of the rear member of



A Simple and Easily Built Trailer Hoist for the Small Contractor, Which Can Be Used to Carry Tools to the Job as Well as for Lifting Heavy Work; Power for Lifting Is Taken from the Tractor Drum

the frame, and is stayed by means of a length of structural iron on each side. These are bolted to the frame at the bottom, and are bent and bored at the top to rest over the upper pivot of the mast. Another stay runs from the top of the mast to the front of the frame. The mast is slotted near the top to take a pulley, mounted by means of a pin driven through a hole bored in the mast. A small pulley is fastened to the side of the mast a little below the large pulley, and on the same side, near the bottom, a rope cleat is screwed. At the bottom of the mast, on the front side, a large pulley with a swivel mounting, is mounted. The top and bottom of the mast are rounded, and iron bands are shrunk over the rounded portions, to prevent the mast from splitting. The pivots are of steel, driven into holes in the mast ends.

The boom is pivoted between two flat steel plates bolted near the bottom of the mast. The boom also has two steel plates bolted on each side at the bottom, to strengthen it and to prevent wear at the pivot. The upper end of the boom is rounded like the ends of the mast, and an iron ring shrunk on to prevent splitting. It is also slotted for a pulley, as shown.



Above, Photo of the Trailer Hoist on the Job; Below, Perspective View of the Hoist, Showing the Lifting and Boom Tackles

One end of the fall is fastened to the top of the boom; the other end is rove through the tackle block, through the pulley slot in the boom, over the pulley in the top of the mast and under the swivel pulley at the bottom; thence it runs to the winding drum on the tractor. The tackle for adjusting the height of the boom is rigged as shown in the drawing, and the end of the fall from the tackle is fastened around the cleat on the mast. The boom is raised and lowered by hand, although it can be done by power from the tractor if desired, in the same manner as the load is lifted.

The entire construction is simple, as the parts are easily assembled, and the hoist is capable of a wide range of work. It will form a useful piece of equipment for the small jobbing contractor in a variety of lines.

Mixing Soils

The best soil for agricultural purposes is one that has approximately equal proportions of clay, silt, sand and humus, and if a smaller amount of any of these constituents is present the value of the soil is correspondingly less. In many cases soils that are deficient in one or more of these constituents can be improved by the addition of other soils having an oversupply, but this method of improvement cannot always be adopted, as the cost is sometimes so high as to make it prohibitive.

It would seem, at first sight, that clay and peat soils could be improved considerably by the addition of sand. Clay is cold and cannot be penetrated easily by air or water, a quality that sand would tend to correct. Peat and muck soils are subject to great extremes of temperature, that is, they warm up rapidly by day and cool off rapidly by night, and the addition of sand seems to be the proper remedy. Application of moderate amounts of sand does not produce permanent results, as the clay and muck seem to swallow up the sand within a short time after it is applied. Only the application of considerable amounts of sand is helpful, and this is in

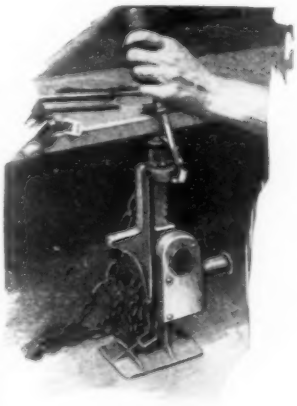
most cases too expensive a solution, as the transportation of sand is very costly, which makes it impracticable for most farmers. If a bank of sand is close at hand so that a large quantity can be easily obtained, this method of improvement will give satisfactory results. Sometimes, however, the value of the land is so great that it pays to spend a large sum to cover it with sand. This usually holds true in the case of a productive cranberry bog, for example, which should be covered with a layer of sand, 3 or 4 in. thick. In this case the sand should not be mixed with the soil of the bog.

Soils that contain too much sand can be bettered by the addition of clay, and it has been found that this method of improvement is, on the whole, much more practical than sanding; it requires far less clay to improve a sandy soil than it takes sand to improve a clay soil, 40 to 60 loads of clay per acre being enough to improve light, sandy soils permanently.

Humus or organic matter can be supplied to soils deficient in this constituent by the addition of peat or muck, or by green manuring, that is, growing a crop and plowing it under. Applying peat and muck is preferable if a supply is close at hand and it can be obtained conveniently. Besides improving the soil physically the addition of muck and peat, which contain a considerable amount of nitrogen, also improves it chemically by enriching it with this element. The muck or peat should be thrown in piles so that the water will evaporate. The material can then be distributed.

Using Jack for Vise

Simple repair jobs on the road are usually easy for motorists having elaborate repair kits, but even these do not always include a vise, which is so often needed. It will be useful, therefore, to know that the jack can be made to serve as a substitute. It is set up under the running board, and the work to be repaired held between the two by raising the jack, as shown.—W. M. Wailes, Jr., Washington, D. C.

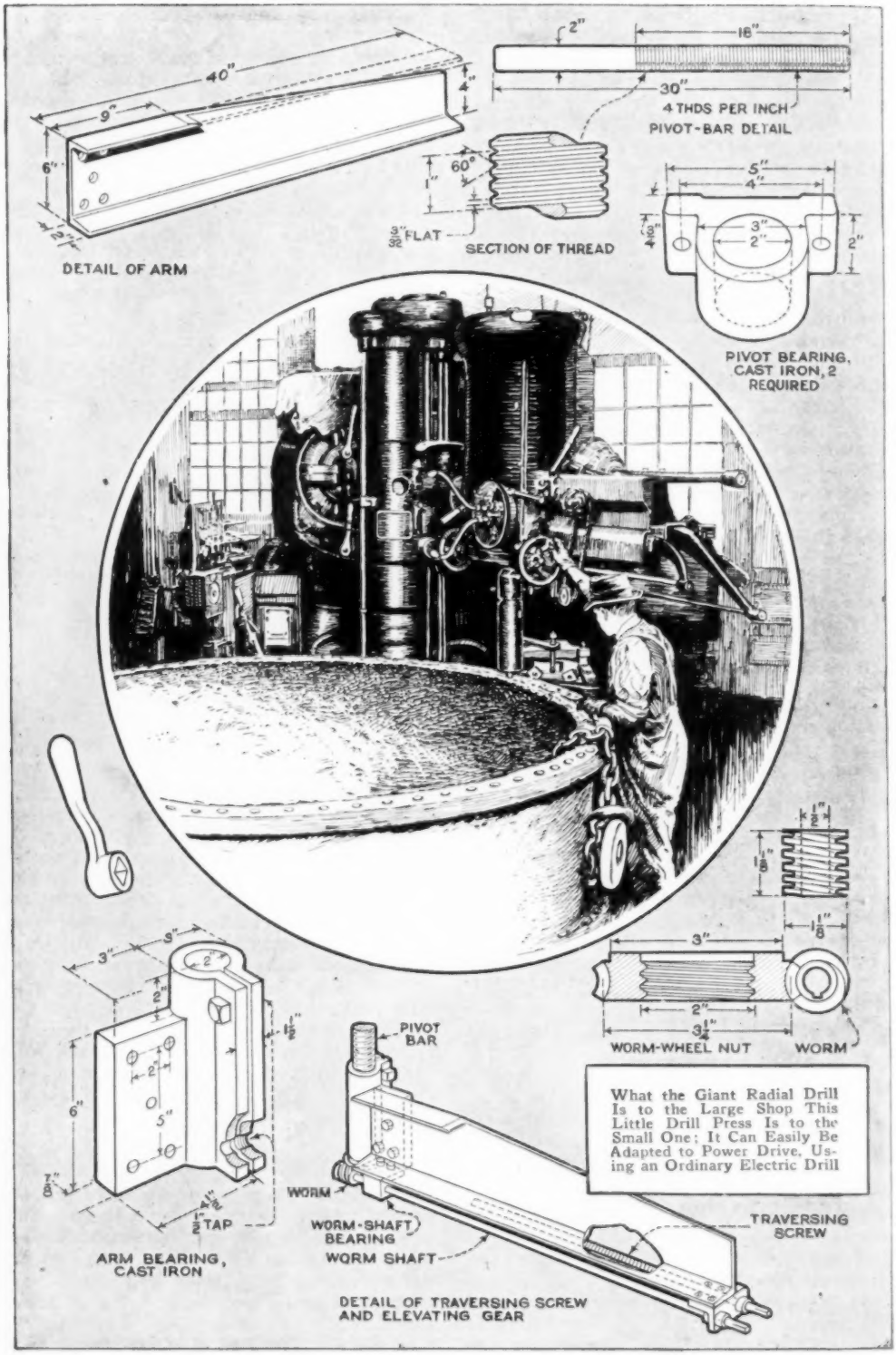


Checking Railroad-Section Gangs

Daily activities of railroad-section gangs are rather difficult to check, but with the aid of the peg post shown in the photo, which serves as a sort of daily time clock, this difficulty has been overcome by a Mexican railroad. The posts are located at the division point between two sections and the numbers of these are painted on a metal plate fastened to the top of the post. Seven holes are drilled on each side of the post to represent the days of the week, the top one representing Sunday, the second Monday, and so on, and two black pegs, one for each side, are provided to fit the holes. When a gang has completed its work on the section and arrives at the post marking the end, it is the duty of the foreman to place a peg in the hole representing the day that the work was completed. Similarly, he places a peg in a hole on the other side, representing the next section, when the work is begun here. The posts are painted white so that the black pegs show very distinctly, enabling trainmen, division superintendents and other railroad officials to keep a constant check on the section gangs.—J. E. Hoag, Los Angeles, Calif.

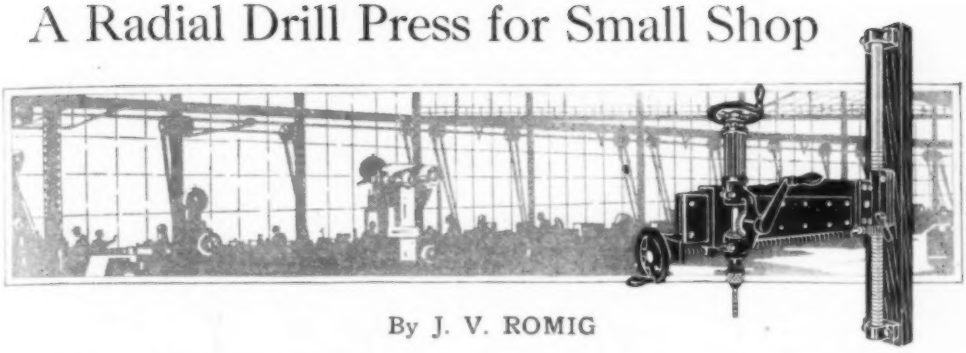
Filing without Scratching

When filing, small particles of metal adhering to the file cause scratches on the work. This trouble can be prevented by chalking the file after cleaning it. Powdered chalk may be used and rubbed on with the fingers or a large piece of lump chalk rubbed over the file.—Dominic G. Kollros, St. Mathews, Ky.



What the Giant Radial Drill Is to the Large Shop This Little Drill Press Is to the Small One; It Can Easily Be Adapted to Power Drive, Using an Ordinary Electric Drill

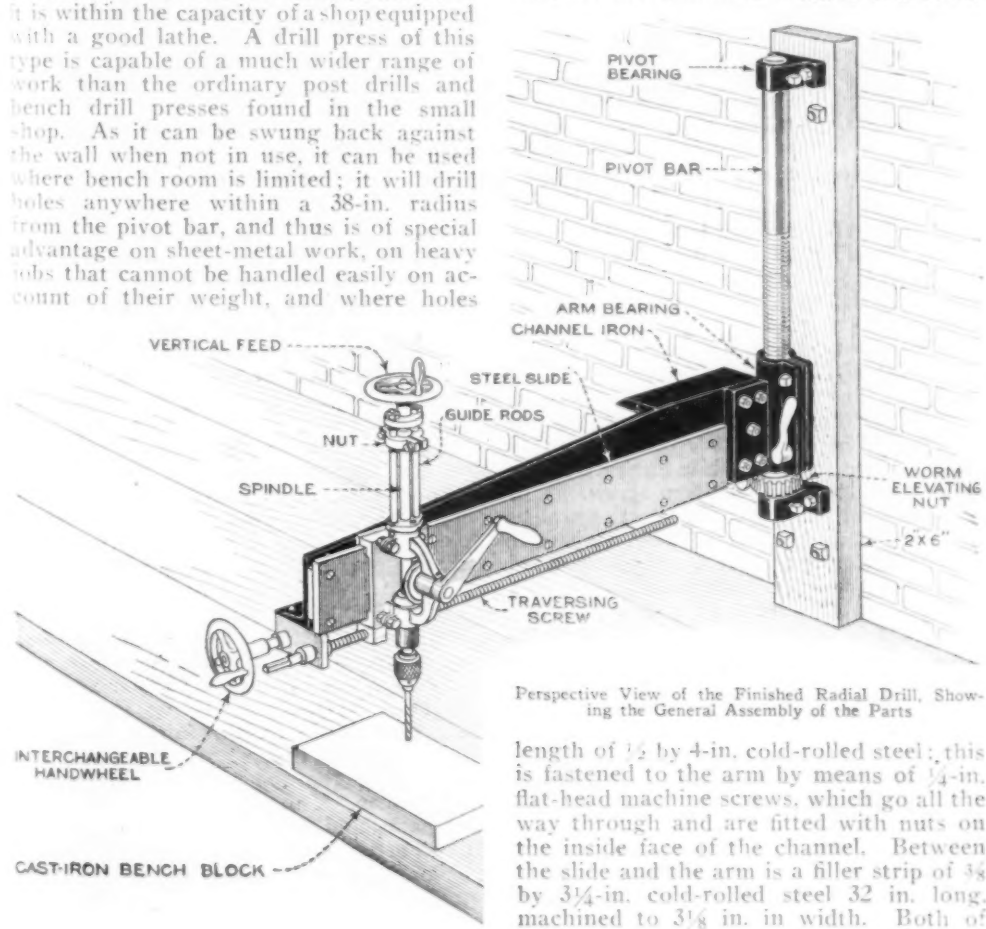
A Radial Drill Press for Small Shop



By J. V. ROMIG

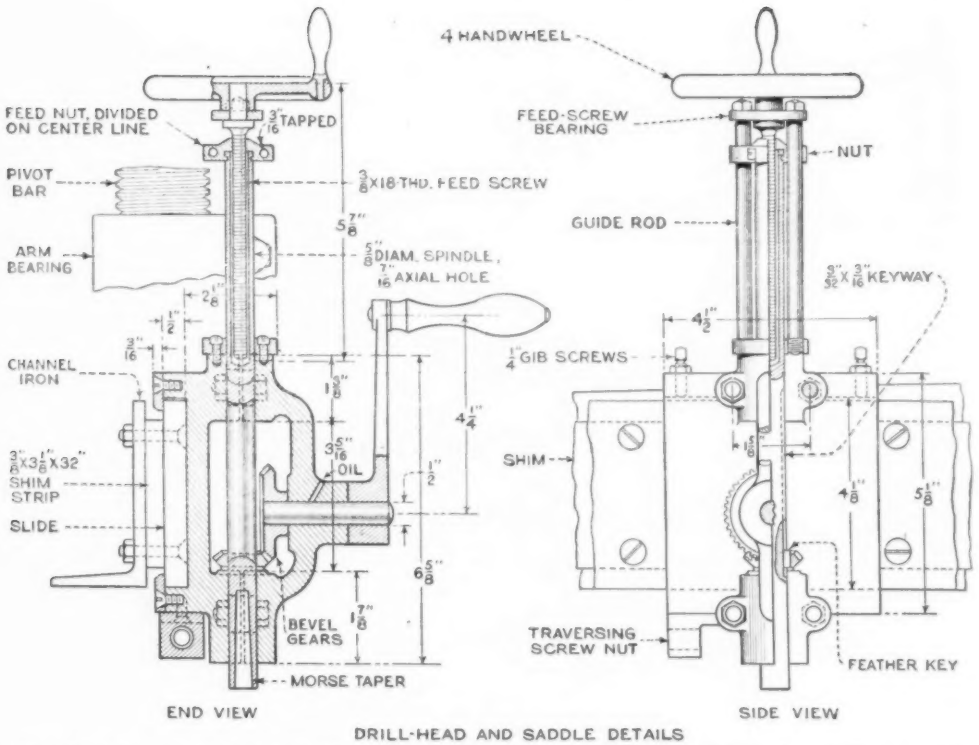
MOST mechanics, while appreciating the value of the radial drill press in the large shop, and realizing what a help such a tool on a smaller scale would be in the small experimental shop, look upon its construction as beyond the scope and capacity of the small shop. Such is not the case, however, as a glance at the accompanying drawings will prove. In this design, the machine work necessary has been reduced to the minimum, and all of it is within the capacity of a shop equipped with a good lathe. A drill press of this type is capable of a much wider range of work than the ordinary post drills and bench drill presses found in the small shop. As it can be swung back against the wall when not in use, it can be used where bench room is limited; it will drill holes anywhere within a 38-in. radius from the pivot bar, and thus is of special advantage on sheet-metal work, on heavy jobs that cannot be handled easily on account of their weight, and where holes must be drilled in the center of pieces of large diameter.

The arm is made of 6-in. channel iron, cut to the length shown in the drawing, and with one flange cut away for a portion of its length. To the rear end is bolted a casting that forms the pivot bearing; the dimensions of this bearing are given in a detail, and it is split and fitted with capscrews and a clamping lever. The slide for the drill head is made of a 36-in.



Perspective View of the Finished Radial Drill, Showing the General Assembly of the Parts

length of ½ by 4-in. cold-rolled steel; this is fastened to the arm by means of ¼-in. flat-head machine screws, which go all the way through and are fitted with nuts on the inside face of the channel. Between the slide and the arm is a filler strip of ⅜ by 3¼-in. cold-rolled steel 32 in. long, machined to 3⅛ in. in width. Both of



DRILL-HEAD AND SADDLE DETAILS

Details of Construction and Assembly of the Drill Head or Saddle; Bronze Bushings May Be Fitted to the Spindle Instead of the Plain Bearings Shown

these cold-rolled pieces must be very carefully straightened and the edges scraped true. It is also necessary to take care that the slide and the pivot bearing are square with each other.

The pivot bar is made of 2-in. cold-rolled steel, threaded for 18 in. of its length. The thread is of sharp V-form at the bottom, but flattened on top, as shown in the detail; this provides a surface for the bearing, while not interfering with the function of the screw. The worm wheel is used to elevate the arm to the desired height; it is made of bronze to the dimensions given, and is actuated by a steel worm on a shaft extending to a bearing on the front of the arm. The pivot bar is held against the wall by pinning it in bearings at each end, which, in turn, are bolted to a stout stringer fastened to the wall by lagscrews or expansion bolts. A plumb bob is used to set the bar exactly vertical on the wall. When in use, the arm may be held fast in any position on the pivot bar by means of the clamp screws.

The drill head, or saddle, is a casting, machined to fit on the slide and drilled and bored for the drill and hand-crank spindles. The bearings are split; the front half of the casting also has the bearing for the crank spindle. A suitable pair of bevel gears, of 1 to 1½ ratio, are purchased, and the larger gear is pinned to the crank spindle, as also is the crank handle; the spindle is ½ in. in diameter, and the bearing is drilled for an oil hole as in the drawing. The small gear is fitted with a feather key, and, when in place on the spindle, rides on a fiber washer. The spindle is turned from good machinery steel, and is bored at the lower end to No. 1 Morse taper. A groove is turned in the upper end to take the feed nut, and a 7/16-in. hole bored axially to clear the feed screw. The groove is highly finished. The feed is effected by means of a split nut of novel design, which is a nice running fit in the groove in the spindle and is threaded internally to fit the feed screw. It is prevented from turning by two guide posts, one on either side, the posts also supporting the top bearing of the feed mechanism. The nut must slide freely on the posts, and is provided with an oil hole. The posts are screwed into a steel collar which is fastened to the top of the upper spindle bearing; a similar collar forms the

upper feed-screw bearing, and to the top of the screw is pinned a small handwheel. The spindle bearings can be fitted with bronze bushings if desired; and this is, in fact, preferable, as it will add to the life of the machine.

The top of the upper saddle slide, bearing on the rail, is tapped for two ¼-in. setscrews, which are used to adjust the gib to the slide. The gib is made of sheet brass, bent up at each end to prevent it from coming out, and both the upper slide and the gib should be drilled for oil holes. A brass or bronze nut for the traversing screw is screwed to the lower surface of the saddle, and a bearing for the screw and the worm shaft is fastened to the front of the arm. The ends of both the screw and shaft are squared to fit an interchangeable handwheel.

A good table or faceplate can be made from an iron bench plate, and care should be taken to see that the press and the top of the plate are square with each other in every direction. The best location for the drill is near the end of the bench, so that the drill can be swung over the end of the latter for work that cannot be raised to the bench. A drill chuck of ½-in. capacity is fitted to the spindle; although the gears are strong enough to drive drills larger than ½ in., it is seldom, in the small shop, that larger drills will be used in the machine. Larger holes, however, may be bored with a boring bar held in the chuck.

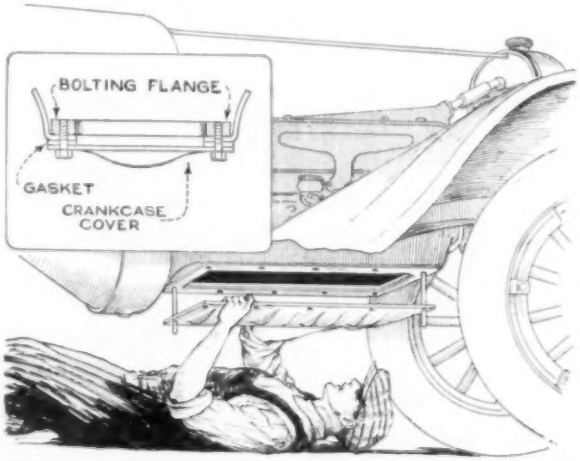
The head may be modified with very little trouble to make the tool power-driven, by using an electric drill and mounting it on a saddle designed on the same lines as the one shown, but modified to suit the drill. If this is done, the tool would be an ideal one for the garage or woodworking shop as well as the small machine shop.

Machining and Finishing Ebonite

Ebonite, which is sometimes called vulcanite and hard rubber, and which is largely used for electrical purposes, is also of great use in the chemical industry, owing to the resistance it offers to chemical reagents. It is stable toward air, light, and changes in temperature up to about 175° F. It can be softened in boiling water and then bent and shaped as desired; the shape or impression is retained on cooling, but if the material is subsequently softened by heat it will return to its original form. In machining it, the tool must be sharp, and to prevent overheating, the cut must not be too heavy. If the tool and the work are not kept cool, the former will rapidly lose its edge and the work will be burnt. In polishing ebonite, the surface should be rubbed smooth with powdered pumice and then buffed, using a tripoli compound, and running the cloth polishing wheel at high speed, the work being held lightly against the wheel. In making ebonite, sheet-metal foils are used as a backing for the plastic material during the process of vulcanization, and this gives the finished sheets their well-known glazed appearance.

Replacing Ford Crankcase Cover

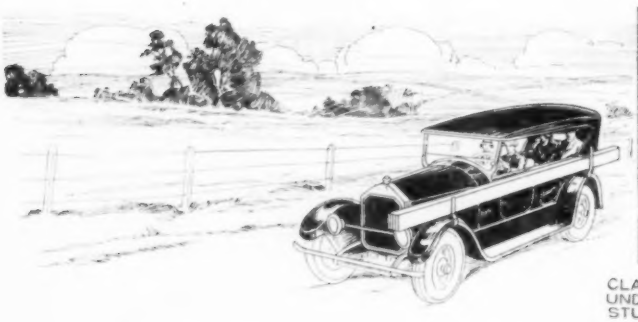
Repairmen are familiar with the difficulty experienced in replacing the cover under a crankcase on Ford cars and trucks as the cover and gasket are assembled first and then held up against the crankcase while the bolts are inserted into a loose flange resting on a lip on the crankcase. A good method of overcoming the difficulty is to screw two threaded studs into the bolt holes in the flange at opposite corners, as shown. The corresponding holes in the cover can readily be brought over these studs and it is then an easy matter to hold the cover up with one hand while replacing the bolts with the other.

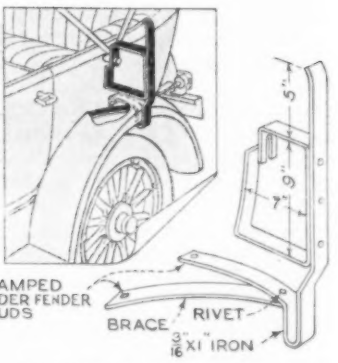


Guide Studs Provide Easy Method of Replacing Crankcase Cover

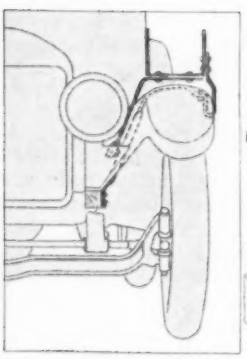
Carrying Brackets for Touring Car

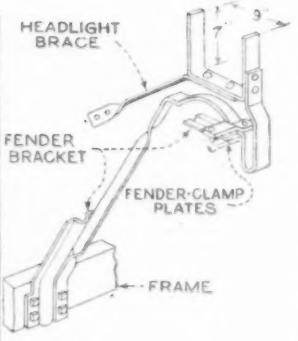
By H. H. PARKER





DETAIL OF REAR BRACKET





Auto Owners Who Are Frequently Obliged to Carry Long Pieces of Material Will Find These Brackets of Great Convenience

THE automobile owner who has frequent occasion to haul timbers, iron pipe or other long material uses much time in trying to lash these to the car, and unless about half-a-dozen blankets are used as cushions, the fenders and the body of the car are sure to be scratched or otherwise marred. Besides, the material usually loosens and slips before being carried very far. The fender brackets described in this article were designed with the idea of providing substantial carriers that could be attached without drilling holes in the fenders or body, in fact, but one extra hole or fastening was used. It is impossible, of course, to show brackets that will answer for every car, but the reader will gain a good idea of the construction from the illustrations, and can easily adapt them to his own car.

The forward fender of the car to which the brackets were fitted was strengthened by a pressed-steel brace, which was fastened to the frame by four bolts, and run up under the lower side of the fender. As the frame bolts extended about ⅜ in. beyond the nuts, it was decided to clamp the lower end of the bracket under the rear pair of bolts, then carry it up parallel with the fender brace, under the edge of the fender and up outside. To this upright projection a U-shaped iron was bolted; bolts were used, as it would have to be removed to get the lower brace into place; another strap was then riveted to the bottom of the U-piece and bent down with a right-angle twist, then bolted to the headlight bracket, under the head of the headlight clamping bolt. All the pieces were of 3/16 by 1-in. iron, bent cold. The upper end of the brace under the frame needed fastening in some way, and investigation showed that a ¼-in. space between the lower side of the fender and its bracket, would be wide enough to admit a length of the iron-bar stock. A piece about 6 in. long was used, and one end offset about 3/16 in. so that the brace could fit over it, between the brace and the lower part of the fender. A second piece was bent to fit under the fender bracket, and the two pieces drilled for a 5/16-in. capscrew, which was put through them and tapped into the bracket. The ends of the pieces on the other side of the bracket were also drilled and a similar screw used to bolt them together, thus clamping the whole to the bracket and making the carrier secure. In fitting, care must be taken to get the parts well up under the fender, else the tire may strike them when running over a rough road.

Unless the rear carrier is allowed to project beyond the fender its capacity will be limited. This particular one was made large enough to carry a 2 by 8-in. piece, or a 4 by 4-in. one; others may be carried by lashing them to the first, all resting on the forward bracket. One

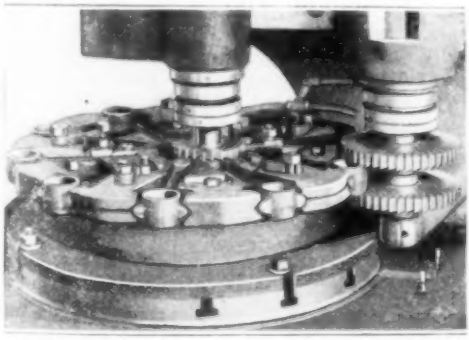
piece of the bar stock was bent around to fit under the rear fender, just below the pivot of the top bows, and clamped under the $\frac{5}{16}$-in. stud that bolted the fender to the car body. To prevent the bracket from working sidewise, a second brace was riveted to it, near the outer end of the fender, and the other end of this was clamped under a stud to the rear of the first one. The projecting part of the bracket was run vertically about 14 in. above the fender, and to it another piece, bent in the shape of an open rectangle, was riveted. One arm of this piece extended parallel with the body (about ½ in. away from it, to protect the side), while the other end was bent down and forked to fit over the $\frac{3}{8}$-in. top-bow pivot stud, and was clamped between the head of the bolt and the sleeve. The pieces to be carried can either be put through the rectangular bracket or rested on top of it, as the vertical projection holds them in place in the latter case.

The brackets were attached to the left side of the car so as to be under the eye of the driver. A second pair can be placed on the right side if desired, and the carrying capacity thus doubled.

Production Methods on Connecting Rods

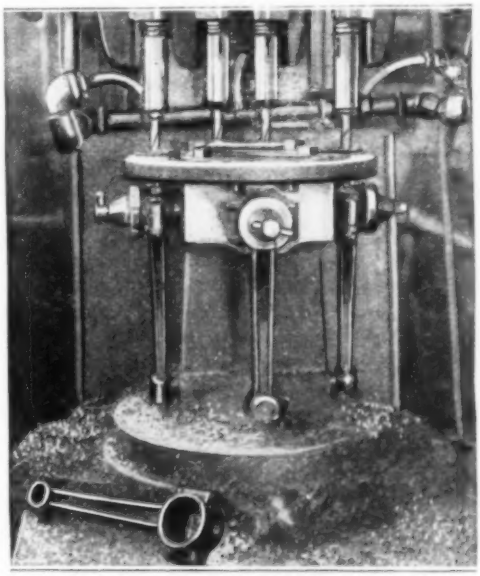
Production of connecting rods has been increased to a considerable extent by a Canadian manufacturing concern, in both milling and drilling operations, by employing the simple yet effectual methods shown in the photographs.

To speed up the operation of milling the faces to size, a number of V-shaped



The Work Is Mounted on the Table and Both Ends Are Faced at Once

locating blocks are fastened on the revolving table of the milling machine, so that 10 connecting rods can be loaded at the same time, in the manner indicated. As the milling machine is equipped with two spindles, and each spindle is equipped with double cutters, it is possible to face both ends of a connecting rod in one operation. The process of milling is a continuous one, as the attendant substitutes



Four Spindles Each Drill a Hole, While the Completed Work Is Removed and a New Part Loaded

unfinished connecting rods for the finished ones, immediately after the latter have passed the cutters, and while the table is revolving.

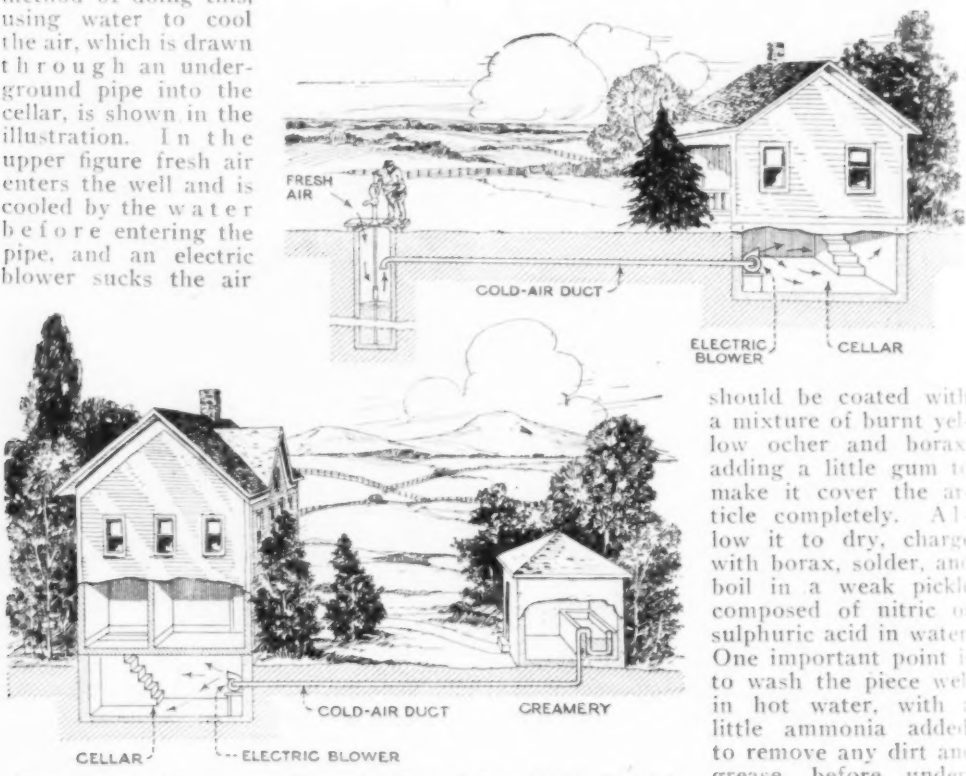
The arrangement of the drill press is somewhat similar to that of the milling machine, the work being mounted on a stand that can be revolved by hand, and can be locked at each quarter revolution. The front station is the loading one; the others are for distinct drilling operations. The connecting rods are mounted on two studs and clamped in place, after which they are swung into the drilling position. All four spindles are lowered at the same time and work simultaneously on different connecting rods.

Dressing Poultry

By dusting powdered rosin into the feathers of each fowl before scalding, dressing of poultry is made a much easier and less disagreeable job. The rosin melts as soon as the scalding water comes into contact with it and causes the feathers to stick together so that they may be rolled off, almost in a mass. The pin feathers of chickens and the down of geese and ducks are removed at the same time.

Cooling and Ventilating Farm Cellar

Nearly every farm has a well or creamery near the house that can be used to advantage for cooling the cellar. A simple method of doing this, using water to cool the air, which is drawn through an underground pipe into the cellar, is shown in the illustration. In the upper figure fresh air enters the well and is cooled by the water before entering the pipe, and an electric blower sucks the air through the pipe and into the cellar. The humidity of the air is also increased by passing over the water. If this method is not possible, a similar cooling system shown in the lower detail can be made to work in connection with the water tank in the creamery, if this is not too far away from the house. The duct, through which the cold air is drawn, is run through the water tank as indicated.



Novel Method of Cooling and Ventilating Farm Cellar with Air Cooled by Contact with Water and Drawn through an Underground Duct

Soldering Jewelry

It is of first importance that soft solder be avoided as far as possible in repairing articles of gold and silver, and even filled and plated jewelry can be repaired with hard solder. To repair a ring, the shank of which requires soldering, bury the setting in a crucible of wet sand, place a small piece of charcoal against one side, and coat the break, previously cleaned by scraping or filing, with borax; charge with solder and blow a flame against the ring until the solder runs in.

Articles that require protection against discoloring in the process of soldering, should be coated with a mixture of burnt yellow ocher and borax, adding a little gum to make it cover the article completely. Allow it to dry, charge with borax, solder, and boil in a weak pickle composed of nitric or sulphuric acid in water. One important point is to wash the piece well in hot water, with a little ammonia added, to remove any dirt and grease, before undertaking any repairs.

If the article is made of colored gold, boil out in a pickle of muriatic acid and water, but never coat with any protecting mixture. To repair gold-filled work, melted solder is required; this may be made in the proportion of 1 oz. fine silver, and 10 dwt. hard brass wire, to which 2 dwt. of zinc is added just before pouring. Or, for strong silver use only the silver and brass.

For repairing most bright gold work, use an alloy composed of 3 dwt. fine silver, 3 dwt. gold, and 2 dwt. fine copper.

A good solder for soldering spectacle frames, or other steel parts, is made by melting together equal parts of silver and copper.—Geo. M. Milliard, Toronto, Ont.

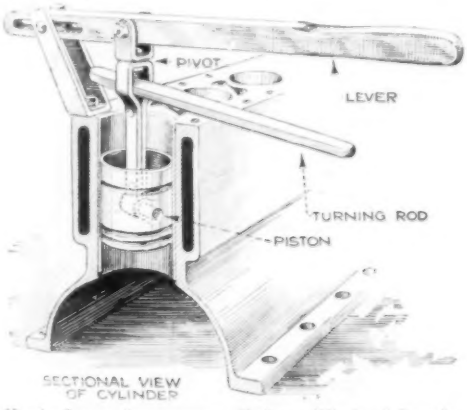
¶Sometimes the dash light on an automobile causes eye strain because of its glare. This can be prevented by slipping a piece of green or blue celluloid inside of the cover.

Tinning Small Work

The work to be tinned is placed in warm water, to which a little sulphuric acid has been added, to clean the pieces of grease and dirt. Some powdered sal ammoniac is then added to the water and vigorously stirred until entirely dissolved. The work is then removed, washed in clean water, and placed near the fire to dry. A shallow pan, such as a frying pan, is obtained, and the bottom perforated. This pan should be small enough to allow it to be dipped into the pot of melted tin. The work is placed in the bottom of this perforated container, and a little sal ammoniac is sprinkled over the surface of the melted metal; then, after all smoke from the metal has disappeared, dip the pan containing the articles into the tin, lift it out, and shake well to get rid of the excess metal, at the same time sprinkling a little sal ammoniac over the work to prevent too thick a coating. The articles are cooled quickly by dumping them into water, which also produces a bright finish.

Lapping Pistons

Lapping pistons by hand is a job that requires considerable effort, but much of the hard work can be eliminated by using a fixture of the kind shown in the illustration. It consists of a simple lever arrangement in which a pivoted, flat-iron connecting rod is fastened to a wooden lever. This lever has a slot cut at one end to permit pivoting the lever on a bolt, which is held in a U-shaped bracket, bolted



Handy Lever Arrangement Reduces Work of Lapping Pistons

down on the block as shown. An extra handle is provided to turn the piston during the lapping process.

Double-Capacity Tool Box

For auto mechanics, carpenters and others whose work makes it necessary for them to carry a tool box around continually, the type shown here will be found very convenient. Although small,

Portable Tool Box Is Compact and Has Double Capacity

its two compartments will hold as many tools as are ordinarily stored in a much larger box. The bottom compartment is made very similar to those of conventional style, only that it is not so deep and the ends extend higher. The upper compartment is of the same shape and also shallow. It is not quite so long as the lower section and the ends are slotted so that it can be hung on the handle. In use, the top compartment can readily be swung sideways to permit one to reach into the lower one, or if desired, it can be removed entirely. Both compartments may be divided into sections for holding small articles.—C. C. Brabant, Detroit, Mich.

Securing Ford Dust Rings

The dust ring in the front hub of Ford cars sometimes shakes out of place even if new and well hammered in. In such cases, it is often helpful to solder the ring to the hub casting. The ring should, of course, be removed and all grease cleaned out thoroughly before soldering.

Refuse Chute for the Store

Instead of disposing of the dirt and rubbish swept from the floor in a refuse can,

Galvanized-Iron Chimney Cowl Makes Handy Dirt Chute in Store

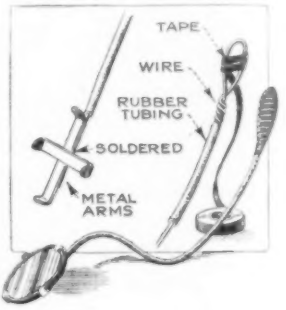
as is usually done, a storekeeper sweeps it into a chute, which leads to a barrel in the cellar. By using this method many steps are saved, as the barrel need not be emptied as often as a small can. The chute consists of an ordinary sheet-iron chimney cowl, which any tinsmith can make. It is arranged as shown in the illustration, a rectangular hole being cut in the floor for the wide end of the cowl, and a trapdoor provided to close the hole.—Frank Harazim, New York City.

Safety in Handling Dynamite

From time to time one hears the observation that "dynamite won't explode from heat—one can burn it without its exploding." This is true in probably 95 per cent of cases, but in the other five dynamite does explode from heat or fire, and hence frozen dynamite should never be thawed in front of a fire, in the bake oven, or on a boiler. Another bad method of thawing is to place the dynamite directly in hot water; this causes the nitroglycerin in the dynamite to come out into the water. The strength of the explosive is lost, and an accident may occur from nitroglycerin sticking to the empty pail. One of the simplest and safest methods of thawing frozen dynamite consists in burying the box in a manure pile and allowing it to remain overnight. If this method is impracticable, a tub may be half filled with warm water, not so hot that the hand cannot bear it, and the dynamite placed in a dry pail, or deep pan, which is set in the water and covered with a piece of old carpet. Always remember that the rules given in the original container are based on a thorough investigation of all accidents. Dynamite is not "fool-proof," and the fact that someone else has taken some "fool" chance in handling this capricious explosive and got away with it, is no assurance that one can do the same thing without being blown to pieces.

Handy Auto Trouble Mirror

The little mirror shown in the accompanying illustration was devised by an auto mechanic to enable him to see around corners when making repairs on auto engines in places difficult to get at. A cross was made by soldering two short strips of flat metal together; a pocket-size mirror was laid over the cross, and the ends of the strips bent over the edge of the mirror to hold it in place. A handle consisting of a length of wire solder was soldered to the back of the cross, and a rubber tube slipped over it for insulation. The end of the handle was enlarged to make it easier to hold; this was done by twisting the solder wire to form a loop and then winding several layers of tape over it. The handle can be bent in any way required to insert the mirror in places otherwise inaccessible. The rubber tube protects the user from receiving shocks when the handle comes in contact with the ignition wire.—L. B. Robbins, Harwich, Mass.



¶When buying a lighting plant and engine for the farm, get an engine large enough to use for power when not charging the storage batteries.

Using Wood Alcohol

Great caution should be observed in the use of any mixtures containing wood alcohol. This is the most deadly poison used in daily commerce; one teaspoonful has been known to cause blindness, and one ounce, death. The poison may be absorbed into the body through the nose, mouth or skin, so that even the inhalation of the fumes, or the contact of the liquid with the hands, or any other part of the body, may cause poisoning just as though the alcohol were taken into the system through the mouth.

Sudden blindness, with vomiting and abdominal pain, should always cause suspicion of wood-alcohol poisoning, and no time should be lost in having the patient treated by a physician.

Lettering Show Windows

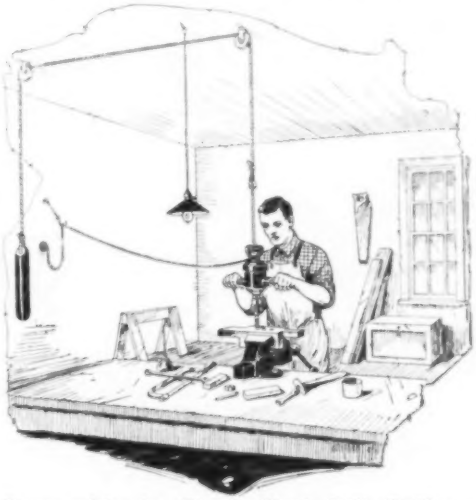
Although distemper lettering on windows has found favor with merchants, it has the disadvantage of being readily damaged by showers and by accidental contact with the clothes of passing pedestrians. This trouble may be eliminated by painting the lettering on the inside of the glass; this, of course, necessitates reversed lettering, and unless the painter is expert a mussy sign may result. To do the job neatly, the letters should be outlined on the outside first, and then traced on the inside, the preliminary lettering on the outside being removed as soon as the inside lettering has been completed. Wedge-shaped pieces of soap are often used for

Lettering on Inside of Store Window Is Protected from Rain and Passing Pedestrians

this kind of lettering, being applied just like crayons.—Philippe A. Judd, Portsmouth, Ohio.

Counterweight for Electric Hand Drill

When using an electric hand drill on the workbench a counterweight will be found convenient. The weight should be about



Counterweight for Electric Hand Drill Facilitates Handling It

equal to that of the drill; it can be arranged on a length of sash cord, run over two pulleys in the ceiling, as shown. After use the drill can be pushed up out of the way and held suspended by the weight. Such an arrangement makes it much easier to handle the drill and causes less wear on the extension cord.

Substitute for Brass Castings

Purchase ½ pt. of muriatic acid and make a saturated solution of zinc chloride. The manner of preparing this solution is to drop particles of zinc into the acid from time to time until no more zinc will be taken up in the solution. Do not inhale the fumes from the acid while it is working. Procure a quantity of brass filings—not spelter—and cleanse them thoroughly in the solution. Melt 8 parts of lead and 2 parts of solder together and, while molten, stir the brass filings in until the mass appears to be all brass; the more brass filings the better. The proportions should be about 8 parts filings to 1 part of the lead and solder.

This metal is especially adapted to work of inventors and can be used in making name plates, brackets, and kindred articles. For molds, either use sand or plaster of paris. If plenty of filings are added to the melted lead it will be hard to detect the finished casting from brass.

Handy Wire-Fence Unwinding Rack

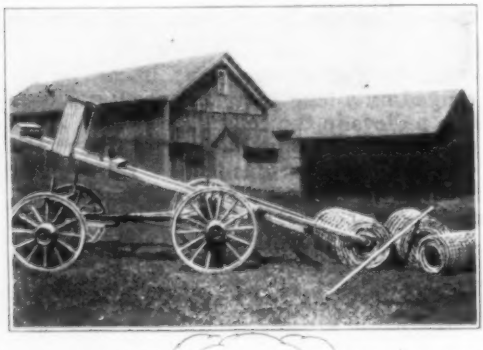
By J. R. KOONTZ

THE job of fencing—a slow and laborious one—can be made easy and much time saved by the use of the horse-drawn unwinding rack shown in the photos and drawings. Most farmers build some wire fence every year and will appreciate such a rack. It can be built of material found on nearly every farm, and it will not take more than a few hours to make it.

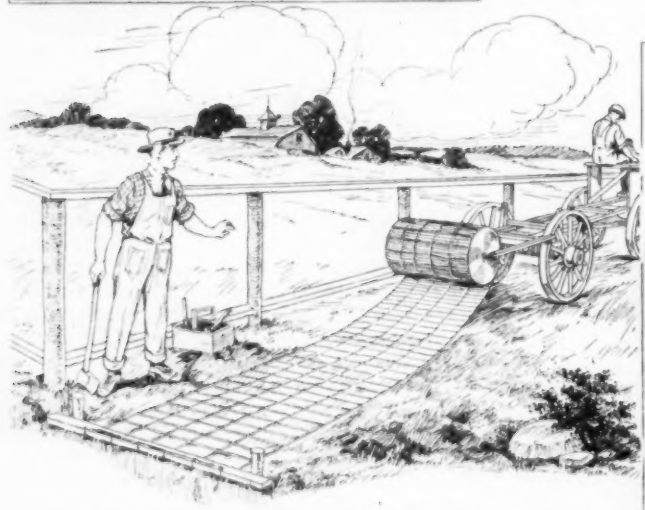
The following materials are used in its construction:

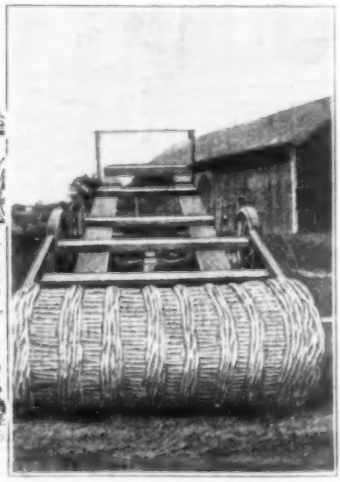
2 pieces 4 by 5 or 4 by 4 in. by 12 ft.
1 piece 4 by 4 by 38 in.
1 piece 2 by 4 by 46 in.
1 piece 2 by 4 by 38 in.
2 pieces 2 by 4 by 56 in.
2 pieces 2 by 4 by 50 in.
2 pieces 1 by 8 by 20 in.
1 piece 1 by 8 by 42 in.
1 piece 1 by 4 by 45 in.
2 5-in. clevises.
30 4-in. spikes and a handful of eight-penny nails.

The two 12-ft. lengths of 4 by 4 or 4 by 5-in. material are laid down and the 4 by 4 by 38-in. piece spiked to the front end. The 2 by 4-in. crosspieces are then spiked on, the two 50-in. lengths nailed about 28 in. apart and the 56-in. lengths spiked to the ends of these, as shown in the drawing. Two spikes are driven at each joint. The seat and its support are made from the 1 by 8-in. pieces, braced with the 1 by 4-in. piece, and securely nailed to the rack near the front end as indicated. About 3 in. from the rear ends of the two 56-in. lengths of the 2 by 4-in. frame, holes are drilled to receive clevis pins. The clevises are then attached and through these a 5-ft. length of iron pipe or a round piece of shafting is passed; hardwood may be used if nothing else is available.



After completing the rack, it is loaded on a wagon chassis. Place the 46-in. length of 2 by 4-in. wood just in front of the rear wagon stakes to keep the rack from slipping back when loading the roll of fencing or when the roll is being unwound. Back the wagon to the roll of fencing and raise the front end of the rack to lower the rear end, which will make it an easy matter to slip the pipe through both clevises and through the roll of fencing. If the roll is not very large the weight of the front end of the rack will raise it, and the driver may comfortably take the seat. However, if the roll is large and heavy it may be necessary to pull the front end down to the wagon and tie it with a rope. When the wagon has been driven to the place where the fencing is to be used, one end of the roll is staked to the ground, or fastened in any other suitable manner, and the team

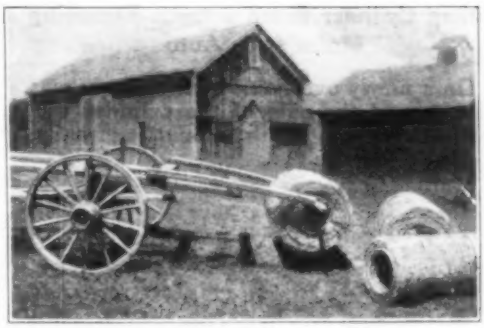


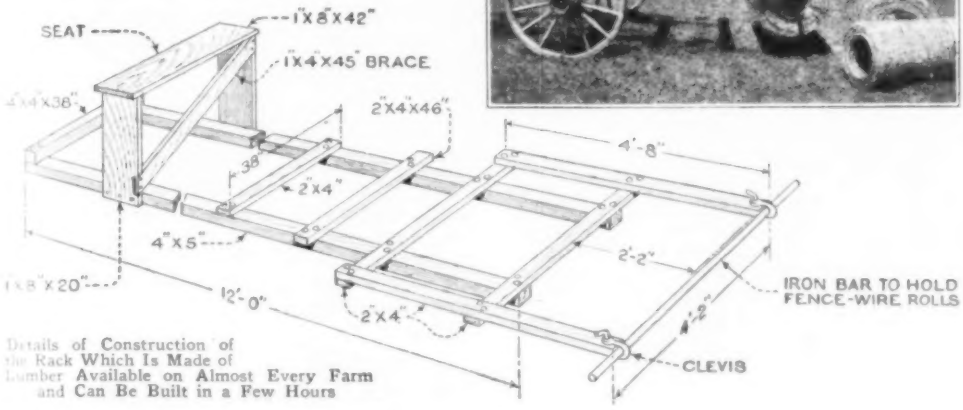


Convenient Fence-Unwinding Rack, Attached to Wagon Chassis, Reduces the Time and Eliminates the Hard Work of Unwinding Fencing by Hand

driven forward. The roll will unwind as fast as the team walks.

When a barb-wire fence is put up, the same method can be used to unwind two or three rolls at once. If desired, a frame of this kind can be permanently mounted on a two-wheeled rig, built especially for the purpose, and it can be



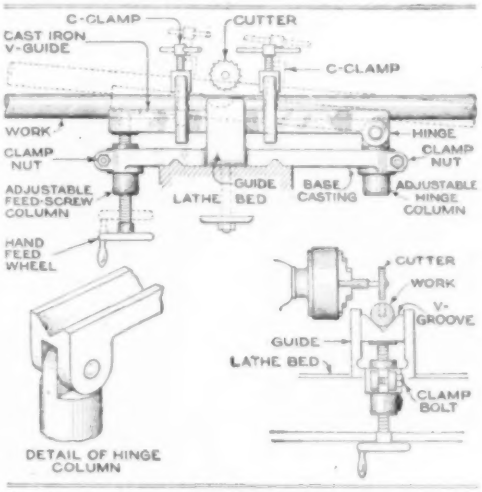


Details of Construction of the Rack Which Is Made of Lumber Available on Almost Every Farm and Can Be Built in a Few Hours

pushed along by hand, which will eliminate the need of using a team of horses. If this is done, it is necessary to change the construction of the device accordingly. When once made, a rack of this kind will give several years of service.

Cutting Woodruff Keyways in the Lathe

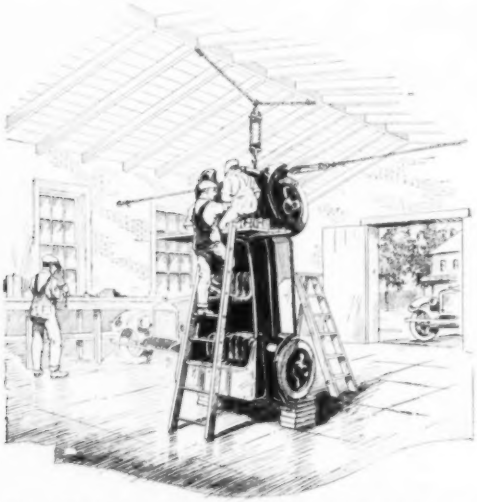
The drawing gives a general idea of a special attachment made for cutting keyways for Woodruff keys in the lathe, the cutter being held in the lathe headstock and backed by the tailstock when necessary. The actual construction of the attachment depends on the type of lathe to which it is fitted, and it may be built up from stock materials or from special castings, as convenient. A base, preferably made of cast iron, is clamped to the lathe bed, the base being planed to fit on the ways. The base has a split boss at each end, with vertical holes and clamp bolts; through the holes are fitted two steel columns, one of which has a hinge joint at the upper end, while the other is bored and threaded for a feed screw. The base also has two upright guides, the inside surfaces of which are machined parallel. Hinged to the rear adjustable column is a long cast-iron V-block or guide, the vee being planed the full length; this is to hold the shaft or work being keyseated. The feed screw merely rests against the lower end of the V-block, which drops by its own weight as the screw is turned down. Two or more C-clamps hold the work firmly in the block while the keyway is being cut. Various sizes of work and cutters are accommodated by adjusting the columns so that the work will sit just below the cutter before the feed screw is operated.



Attachment for Cutting Woodruff Keyways in the Lathe, Which May Be Built from Stock Parts

Filling Cylinder Score without Removing Motor from Auto

On a newly overhauled car a piston was broken and the side of the cylinder was slightly scored. This would, normally, have meant the removal and dismantling of the whole engine. However, it was suggested, jokingly, that the car be stood on end and the score filled, and the joke was developed into a practical scheme for raising the car and holding it in upright position by means of the rigging shown in the drawing. The air vent in the gasoline tank was plugged, the front dustpan was removed, and a short, stout iron bar was placed between the front springs and the nose of the frame, so that a tackle could be attached. The tackle was suspended from the ridgepole of the roof, which was braced in a suitable manner. The rear wheels were blocked up as indicated to keep the fenders and gasoline tank from touching the floor. When nearly perpendicular two smaller tackles were arranged horizontally as shown, and the car thereby prevented from tipping sideways. A board was placed across the windshield on which the workman stood to fill the score. It took about an hour for two men to raise the car to this position, but at least two days' labor was saved for one man. The same method can be employed if the score is on the front side of the cylinder, but the car must then be held with the front end down.



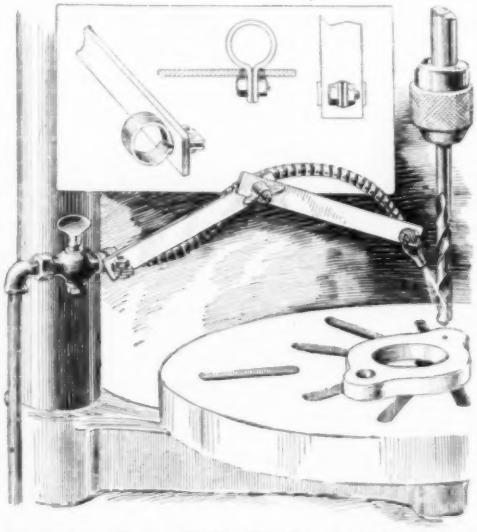
Novel Method of Filling Cylinder Score Saves Considerable Time Dismantling Engine

Hanging Metal Molding

Electricians have difficulty at times when putting up metal molding on account of the springiness of the strips, particularly with the coping. I have discovered that if the lips of the coping are slit with a hacksaw every few inches, this difficulty is overcome.—P. J. Alart, New York, N. Y.

Clamp for Flexible Tubing

On machines using cooling liquids or cutting compounds, flexible tubing, on account of its pliability, is often used to convey the fluid to the work or tool. However, some difficulty is encountered when it is desired to hold the tubing in a fixed position so that the spout delivers the spray directly on one spot. Machine vibration usually makes it necessary to adjust the spout continually or resort to makeshift methods such as tying the tubing with string. A much better method of holding it is shown in the drawing. Two clamping pieces to fit the tubing are made of thin sheet metal. These are placed at either end, and both are clamped on with nuts. Two lengths of thicker sheet metal are drilled at each end so that they can be passed over the clamping pieces and held in place behind the nuts. A thumbnut and screw are used to bind the two pieces together in the middle.

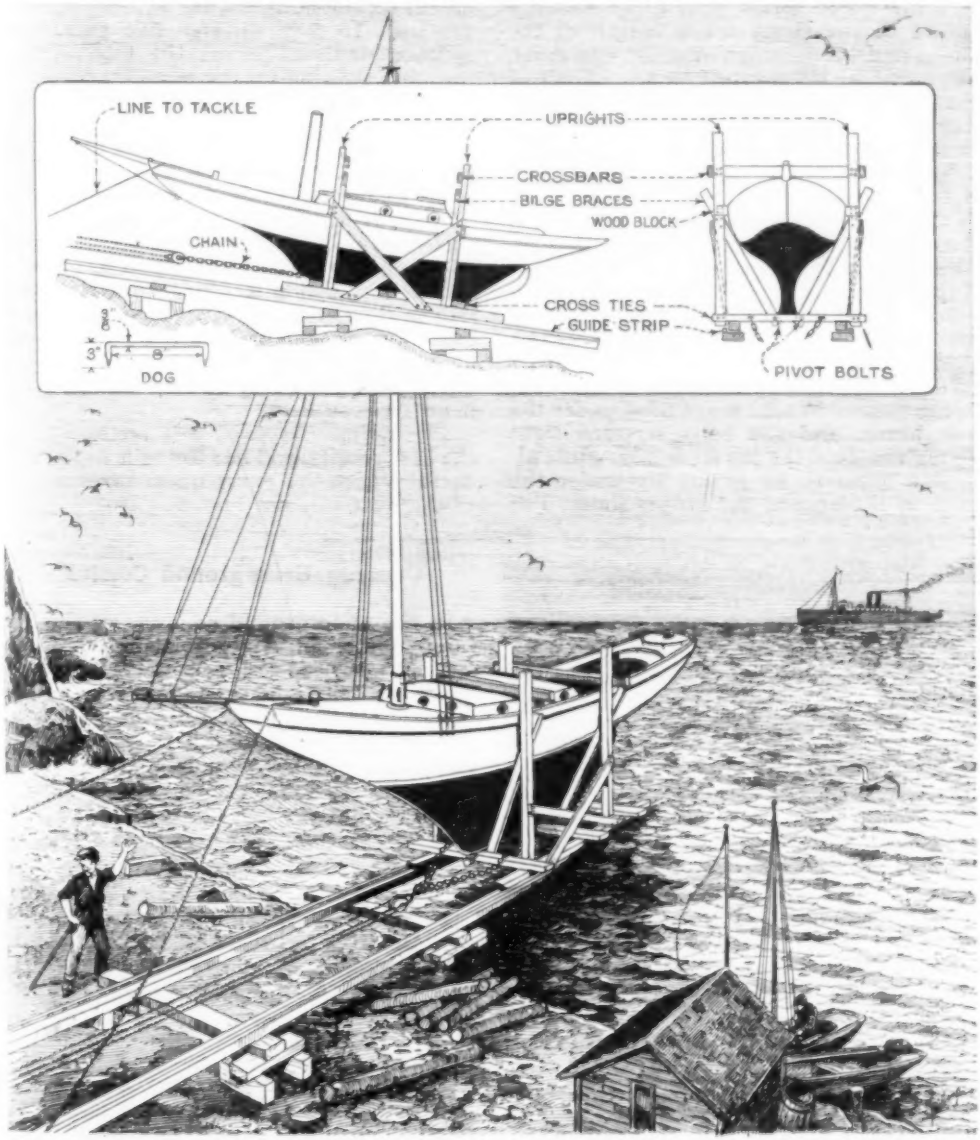


Convenient Clamp Holds Flexible Tubing in Any Position

Homemade Boat Railway for Small Yacht Repairs

By J. A. STEVENS

MANY times the small-boat or yacht owner would like to haul up his own boat for repairs, overhaul or winter storage. This is difficult without special equipment; the accompanying drawings, however, show a simple railway that will enable the job to be done easily. Such a railway is of use not only to the individual owner, but to the small repair yard, the owner of which does not wish to go to very great expense in installing a marine railway. The first thing to consider is the form of the boat and its weight. The writer has taken as an example a short-hull, deep-draft boat, as this is the most difficult type to handle. First the arrange-



To the Small Repair Yard as Well as the Individual Yacht or Small-Boat Owner, This Homemade Marine Railway Will Prove of Value; the Underwater Shape of the Boat Need Not Be Known

ment must have suitable launchways; these must be run from the place where the work is to be done, or the boat is to be stored, a sufficient distance into the water so that the boat can be floated into its cradle at high water. The ways must be substantially blocked, and must be so laid that they cannot spread. On the outer edges of the ways 2 by 3-in. guide strips are nailed.

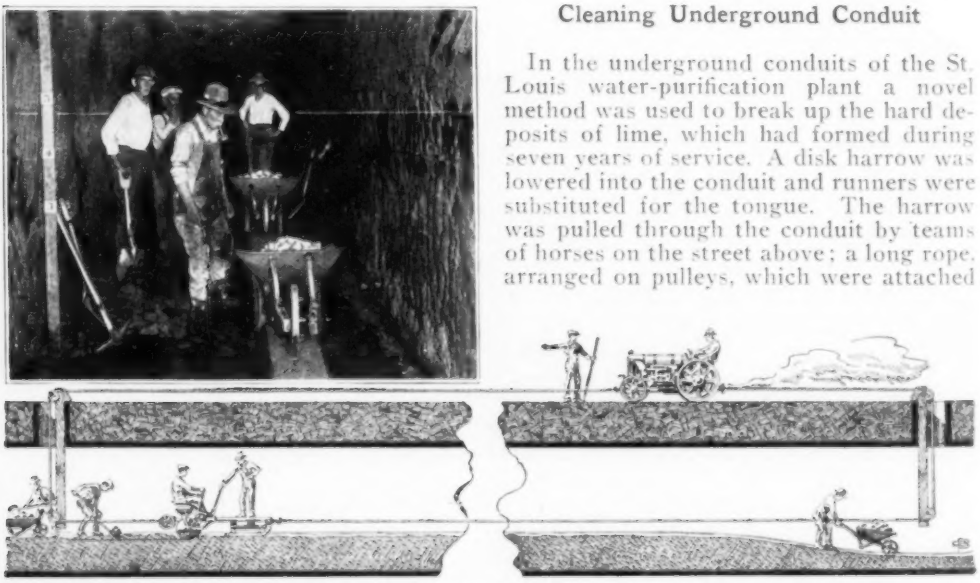
The slide pieces of the cradle are now placed on the ways, with about ½ in. clearance between the edges of the slides and the guide strips, and cross ties are spiked to the slides. The length of the slides and the number of cross ties must, of course, be determined by the length of the hull that bears on the ties. After the ties are in place, the uprights are spiked to the end ties, as shown in the drawing: 2 by 6-in. planks are suitable for the uprights. These are braced fore and aft with ⅞ by 6-in. boards, taking care to keep these clear of the hinged bilge braces. The latter are made of 2½ by 6-in. spruce, if the boat is not over 30 ft. long; a ⅝-in. hole is bored in one end of each, and they are then bolted to the end cross ties as shown in the end view, far enough apart to allow the keel of the boat to drop between them. Washers are used under the bolt heads, and the bolts screwed tight enough to hold the braces firmly, while allowing them to be swung up under the bilge of the boat at the proper time. For a longer craft, heavier braces should be used. The cradle is now ready to be placed on the ways, which, of course, is done at low water. It is fastened to the ways by means of dogs made as shown in the detail, to keep it from floating until the boat is in position. These are pulled out when the boat is ready to be started up the ways. The boat should be placed in the cradle just as soon as there is depth enough of water over the cross ties to float it there. Care should be taken that it is upright fore and aft on the ties. Nail some small blocks on the uprights, and bearing against the hull, to take up any side play, and spike crosspieces across the tops of the uprights. Swing up the bilge braces until they bear against the hull, and fasten them securely to the uprights.

Now make a couple of lines from the boat fast to the tackle to keep the cradle from being pulled from under the boat when it is first started. The boat is then ready to be hauled ashore. For a heavy 30-ft. boat a double-block tackle, with a double and single-block tackle for a luff, will easily do the job with three men hauling. Use plenty of grease on the ways, and be sure that everything is strong enough for the boat; be sure also to keep it on an even keel.

The writer has used this method with the best results, and has found it especially useful where the exact underwater shape of the boat was not known.

Cleaning Underground Conduit

In the underground conduits of the St. Louis water-purification plant a novel method was used to break up the hard deposits of lime, which had formed during seven years of service. A disk harrow was lowered into the conduit and runners were substituted for the tongue. The harrow was pulled through the conduit by teams of horses on the street above; a long rope, arranged on pulleys, which were attached

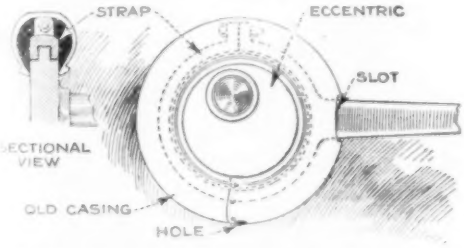


Above, Old Method of Removing Lime Deposits, with Pick and Shovel; Below, Diagram Showing Improved Method, Using a Disk Harrow to Break Up the Deposits

to frames at each end of every 410-ft. division of the conduit, was connected to both harrow and team. A tag line served as the pulling line on the return trip. Two men rode the harrow and adjusted the disks to suit the hardness of the lime deposit. When the deposit had been broken up thoroughly the conduits were flushed out by running 12 in. of water through them at a velocity of about 4 ft. per second. Obviously, the cost of this method was much less than if men had been employed to do the work with pick and shovel. A tractor could be used instead of horses, as suggested in the drawing, and would probably decrease the time required.—Martin Bunn, Babylon, N. Y.

Protecting Eccentric on Cement Mixer

The plunger that feeds the cement to our concrete mixer was driven by an eccentric on the main shaft from the belt wheel, and the particles of cement that got under the strap on the eccentric soon wore down the guiding ring, letting the strap and rod fall off. This was remedied in the following way: A piece of 30 by 3-in. auto casing, long enough to encircle the strap and overlap an inch or so, was wrapped around it. This brought the bead down over the rim of the eccentric about 2 in. A slot was cut in the casing at the place where the eccentric rod passed through and another hole at the bottom so that particles working in might readily fall out. The overlapping ends of the casing were then



Old Auto Casing Prevents Cement from Getting under Strap on Eccentric of Concrete Mixer

riveted together, allowing its inner surface to rest on the lugs of the strap. The tube of the compression grease cup was lengthened so that it extended to the outside, a hole being provided in the casing for this purpose. Springs of heavy wire were forced over the casing at intervals of about 4 in. to hold it close to the sides of the eccentric. The protection thus given was found effective and no further trouble was experienced.—Geo. G. McVicker, North Bend, Nebr.

A Device for Covering Up Seeds

Every home gardener has found that the apparently simple task of covering up seeds is really rather troublesome. A

Simple Homemade Garden Implement Covers Rows of Seeds Quickly

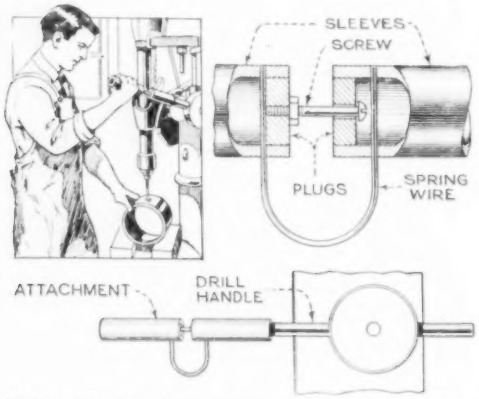
simple device, which will do this quickly and thoroughly, is shown in the accompanying illustration. All that is necessary is to set the device over the seeds and pull it backward. It consists of two wings of galvanized iron or heavy tin, about 3 in. wide at one end and 8 in. at the other, and 12 in. long. These are fastened together with an iron band, 6 in. long, bolted to the wings, as shown, about 3 in. from the narrow end. The parts are held together with 3/16-in. stove bolts. The whole frame, which holds the blades, can be made of one long piece of flat iron, heated and bent to the shape shown. An ordinary broomstick can be used as a handle. —Bessie O. Johnson, Belton, Tex.

Testing Lumber Waterproofing

Lumber treated with waterproofing compound can readily be tested by taking four pieces of treated stock, about 1 by 1 by 2 in. in dimensions, and nailing them to strong crosspieces at each end so that there will be a space between them about equal to the thickness of a hacksaw blade. The wood is submerged in water for 24 hours. If in that time the strips have swelled so that they fit tightly together, the waterproofing compound is worthless.

Sensitive Drill-Press Handle Attachment

Every shop is not equipped with a sensitive drill press and consequently it is often difficult to bore small holes without breaking the drill, as the operator is unable to tell when the pressure is becoming too great. The trouble can easily be remedied by providing a spring attachment on the handle, as shown in the drawing. It is made of two short lengths of steel tubing having an internal diameter equal to that of the machine handle, on which one of these pieces is wrung. The adjacent ends of the pieces are plugged, one plug being drilled and tapped for a small machine screw and the other drilled an easy sliding fit on the shank of the screw. The tubes are linked together with the screw, as indicated, so that there will be a little space between them. Holes are drilled through both tubes near the ends and a piece of light spring wire is inserted, as shown, leaving a little play between the screw head and the plug in the tube that is slid over the drill-press handle. This arrangement provides a means for more sensitive feeding and will prevent much lost time due to broken drills.—Harry Moore, Montreal, Can.



Spring Attachment on Handle Makes Ordinary Drill Press Sensitive

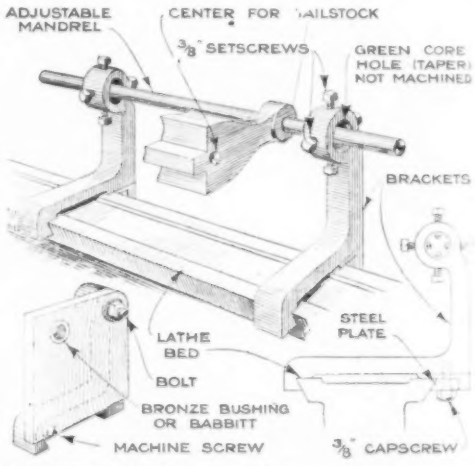
Lathe-Bed Brackets

A small screw-cutting lathe that was supplied with a milling and grinding attachment had two cast-iron brackets made and fitted so as to be clamped to the bed as shown in the drawing, and these proved to be of great convenience in many ways. The pattern is simple, the hole being made tapered so that a green-sand core may be used, and no machining is required. Hand filing only was required to fit the brackets to this type of bed; a ⅜-in. length of flat steel was filed on one edge to a 60° angle and held to the underside of the bracket by a ⅜-in. capscrew. This clamped the bracket firmly to the bed when the screw was drawn up.

The eye of each bracket was drilled and tapped for four ⅜-in. setscrews, one pair of holes being drilled and tapped from the top and the others from the rear to allow working room for the tap wrench; these setscrews are used to clamp a cold-rolled steel mandrel and for accurately adjusting it parallel to the travel of the lathe carriage, as determined by a dial indicator clamped to the tool slide and bearing against the side and top of the mandrel.

In use, the mandrel, which is set several inches to the rear of the lathe center line, had clamped to it various pieces of work, the surfaces of which pointed to the front and were to be milled or ground by attachments on the tool side; if clamped between centers the work would project too far forward and the milling cutter would not have room to work. The work is readily blocked up from the bed, if additional support is necessary.

Another use is that of an emergency steady rest, a hardwood board, drilled and reamed to take the work, or bushed with metal, being bolted or clamped to the bracket as shown in the left-hand detail. If two such rests are used and the work adjusted parallel to the carriage travel, and there is no play between the work and steady-rest bearings, the work will run absolutely true, provided a flexible connection is used for driving.



Brackets for the Lathe Bed Make It Possible to Use Milling and Grinding Attachments with a Minimum of Difficulty

Prize Offers and Announcements

$150—Best New Uses for Stop Watch

Two awards of $100 and $50; also ten additional awards of one stop watch each. These offers are made for the best lists of uses for the Pastor stop watch, which is an accurate instrument consisting of a timepiece and a stop watch in one. Particular value is placed by this concern on uses promising great savings to the user. Leading engineers claim that in the industries millions of dollars are wasted owing to lack of attention to the time element in operations. The Sterling Watch Company, Inc., wishes to learn all the uses to which the Pastor stop watch may be put. The larger sum of the cash offers will be paid for the best list, the smaller sum for the second best and a Pastor stop watch valued at $7.50, will be given for each of the next ten best series of uses received. The instrument can be examined by entrants at practically any local watch dealer's establishment. Each use should be stated briefly and simply and numbered according to its place on the list. Write on one side of the paper only, with name and address on each sheet. Address all replies to Industrial Award, Sterling Watch Company, 15 East Twenty-Sixth Street, New York, N. Y. Offer closes May 1, 1925.

$1,000—Adjustable Miter Box

The sum of $1,000 in cash and a satisfactory royalty will be paid by Roche and Moore for a suitable miter box for carpenters, to be employed with the ordinary handsaw. The design must be such that it can be easily and quickly adjusted to any arc of a half circle. It should be one inexpensive to manufacture, should be light in weight and preferably planned to be constructed of either wood or steel. No models of suggested designs should be submitted until after the drawings or sketches have been sent to the donor. This concern reserves the right to be the sole judge of the merits of all ideas submitted and their availability for adoption by our organization. Address Roche and Moore, Cochranton, Pa. This offer expires May 1, 1925.

$100—Eliminating Radio Interference

The Saranac Lake Radio Club will pay the sum of $100 to anyone submitting a successful device for the elimination of interferences to radio reception set up by electric heating pads. The pads are widely used by outdoor resorters and as each heater is equipped with a thermostat regulator they cause serious interruption to the operation of radio receiving sets. The eliminator must be available for practical application to such heating pads as are now in use and causing the trouble. Detailed information on the subject will be sent to anyone on request. This organization or its representatives will act as judges of the merits of any plans, methods or inventions submitted. Address Interference Committee, Saranac Lake Radio Club, Saranac Lake, New York.

$1,000—Article to Increase Brass Uses

With the person who designs some acceptable article which is composed of considerable brass in the form of sheet, rod or tubing, and which can be protected by patent, or with anyone who develops an acceptable plan wherein brass can be successfully and usefully substituted for a competing material now used in established articles of commerce, the Bridgeport Brass Company will enter into an agreement to pay royalties on the basis of such an invention, plan or suggestion, up to $1,000. The Bridgeport Brass Company will be the sole and final judge in reaching a decision regarding the commercial value of the invention, plan or suggestion, but if the company approves and enters into such an agreement in any instance, and reward is paid up to an aggregate of $1,000, payments shall then cease and the Bridgeport Brass Company shall become proprietor of all rights, privileges and returns from the promotion, manufacture or sale of any such patent, plan or suggestion the Bridgeport Brass Company adopts under this offer. May 1, 1925, is closing date for this offer. Address Bridgeport Brass Company, Bridgeport, Conn.

OFFERS ANNOUNCED IN PREVIOUS ISSUES

All of These Offers Expire May 1, 1925

FOR THE BEST SUGGESTED IMPROVEment on a gasoline-heated blowtorch and soldering and beading iron combined an award of $500 will be paid by the Everhot Manufacturing Company.

AWARDS OF $500 EACH WILL BE PAID for a waterproofing process for a library paste and a method that will produce increased sales of this product. John J. Harris and Company.

$2,000 WILL BE PAID BY THE NORTH Shore Food Products Company for a method of processing or preserving cottage cheese to keep it fresh for at least two weeks.

THE SUM OF $25 WILL BE PAID BY CELLO Products, Inc., for suggested new uses for its product. Information from the concern on request.

FOR NEW WAYS OF USING BUTTON molds $500 will be paid by donor in Problem HA-1, and the same concern will pay $500 for new uses for button-mold machines as stated in Problem HA-2.

THE SUM OF $50 IS OFFERED BY THE Parsons Manufacturing Company for the best plan they receive for uses of ground slate.

ELECTRIC HEATING ELEMENT WHICH will operate and interchange with base and cover of Imperial self-heating gasoline iron, $500. Imperial Brass Company.

DISCOVERY OF NEW USES FOR CARBONdioxide gas or improvements to present uses. Award $1,000. Liquid Carbonic Company.

NATIONAL BRASS COMPANY WILL PAY $300 for design of key guide that can be made of sheet metal and which will properly fit escutcheon plate of similar material.

TO ANYONE WHO WILL PRODUCE FOR them a saxophone reed to satisfactorily replace the present reed, the Buescher Band Instrument Company will pay the sum of $1,000.

THE PHENIX RADIO CORPORATION WILL pay the sum of $1,000 for the design of a new form of condenser for radio reception.

FOR A SATISFACTORY HAMMER-BLOW arrangement for portable hammer drill, the Wodack Electric Tool Corporation will pay $500.

FOR SKYROCKET STICK HARMLESS IN descent, $1,000; bombshell with illuminated flag, $250; chemical combinations to produce smokeless fireworks colors, $250. Thearle-Duffield Fireworks Company.

MOTOR-OPERATED HANDSAW FOR MANUfacture and sales; award, $10,000 in royalties. R. L. Barker and Company.

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Radio Questions and Answers

Q. I would like to build a five-tube neutrodyne receiver. Can you furnish me with diagrams and building instructions? I live close to the Mexican border, but would like to get the broadcasting stations in the northern states. I now have a one-tube set and cannot reach very far. A. We published the complete working details for the construction of this receiver in the February and March, 1924, issues. You can obtain these back numbers from our subscription department at the usual price. We can also supply you with a large blueprint of the circuit if you wish.

Q. I have a three-tube regenerative set, using three UV-199 tubes. How can I make it more selective? A. Place a .0005-mfd. variable condenser across the secondary of the variocoupler, and another variable condenser of .001 mfd. capacity in series with the aerial or the aerial and ground. This will give you very selective results.

Q. My two-step amplifier does not seem to have enough volume. Does it make any difference which side of the filament the secondary of the transformers are connected to? A. It is very important that the secondary terminal of the transformer at the lower end is connected to the negative side of the filament. Most transformers are marked F- at this point.

Q. I have a two-tube receiver, a detector and one step of amplification. How far should I be able to hear with this set using a good pair of ear phones on "silent night"? A. This depends on the type of receiver you have, the condition of the batteries, the efficiency of the aerial and ground, your location, atmospheric conditions and, last but not least, your ability to tune the instrument. Remarkable distances have been covered with two-tube receivers under good conditions, but no one can tell you just how far you will be able to receive, as there are too many angles to be considered. A conservative range would be from 500 to 1,000 miles.

Q. What do you consider the best crystal? I have tried several kinds and cannot find a good one. A. Galena is a very good crystal. There are also many synthetic crystals now on the market that are very good. The best way is to get several, as they are low in price, and try them out. A large piece of galena can be purchased, broken up small, and each piece tested. Handle the crystal with a small pair of tweezers, as the surface should not be touched with the fingers. If you have crystals that have been handled, wipe them off with a little benzine; you will find that it will then be easier to locate the sensitive spot.

Q. I would like to connect a number of phones to my receiver. Should I connect them in series or parallel? A. The phones should be connected in series.

Q. Can I use a loud speaker with my two-tube receiver? It is a one-step spider-coil set that you described in the February, 1923, issue. A. This instrument was not designed to be used with a loud speaker; it would be necessary for you to add another step of audio-frequency amplification to the instrument to enable you to use a loud speaker on distant stations. However, for local stations, a loud speaker may be used with fairly good results.

Q. I have been given an old set of the homemade type. The circuit seems good, but many of the connections are corroded; how can I put it in shape? It is a two-step regenerative receiver. A. Copy the circuit carefully for reference, then take off all the wiring, and place new soldering lugs under the terminals of all the instruments. If the rheostats are loose and make poor contact, get new ones. Clean all dust and dirt from the blades of the variable condensers, using a common pipe cleaner for this purpose. See that the sockets are in good condition, and that the clips make good contact with the prongs on the tubes. If there are any pigtail connections, such as are commonly used on variometers and condensers, see that these are not broken. Rewire the set carefully, soldering each joint. See that the jacks are not shorted by corrosion. To test the transformers, use a pair of phones with a dry cell in series and test each primary and secondary; if they are in working condition, you will get a click in the phones, if not, put in new ones.

Q. Will you please tell me if I can use a storage A-battery on my UV-199 tubes. A. Yes; there are several 4-volt storage batteries on the market for this purpose.

Q. I am having difficulty in soldering the connections on my set. The flux runs under the instrument terminals. I am using wire solder with the flux in the core, and it does not seem suitable for this kind of work. A. Use a solid-wire solder, get a small tin of soldering paste and use the paste sparingly on the lugs to be soldered. Use the paste more to clean the terminal than to act as a flux. If tinned-copper wire is used for the circuit very little flux is required.

Q. What is the difference between audio-frequency and radio-frequency transformers? This point has never been explained to me. A. Radio-frequency transformers are used before the detector tube to amplify the weaker signals to a point where they will actuate the detector. Audio-frequency transformers are used after the detector to amplify the signal at frequencies that can be heard.

Q. How many turns of wire should I place on my loop? I have made the frame two feet square. What kind of wire should I use? A. Wind 12 turns of No. 18 flexible rubber-insulated and braided wire on the frame, spacing the turns ½ in. apart. Lamp-cord can be used if this wire is unobtainable, but it does not make as neat a job.

Q. Should I shield my superheterodyne receiver? Some say to shield, other not to. Do shields cut down volume? A. Shielding is necessary in superheterodynes between the various stages. A well-shielded set will tune more closely and body capacities will be eliminated; this offsets any loss of volume, as you usually have more volume than you know what to do with in any case. Volume can always be sacrificed for clarity in a multi-tube receiver.

Q. How can I make a tube-protecting device? I have burnt out several tubes and hesitate to buy more until I can find some means of protecting the filaments. A. To protect your tubes place a 110-volt carbon lamp in series with the B-battery so that the current must pass through this lamp before going to the set. This protects your tubes in case of a short circuit.

The Radio Department is willing and anxious to serve you. If you contemplate buying or building a set, we will be glad to advise you in selecting the proper instrument to suit your purpose, furnish you a circuit, or tell you where to get the best parts. When you run into trouble in building or operating your set, tell us about it, and we will endeavor to clear it up for you.

Address all inquiries to the Radio Editor, Popular Mechanics Magazine, 200 E. Ontario St., Chicago.

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